

Popular Mechanics

APRIL 1981

\$1.25

2,000,000-MILE DRIVE REPORTS
FORD ESCORT & DODGE ARIES
At last—two domestics better than imports, say owners

**A MASTER CRAFTSMAN'S
9 BEST BUILT-INS
FOR TOOL STORAGE**

**SPACE SHUTTLE:
The critical systems
that must not fail**



**SPECIAL: 32 PAGES
HOME IMPROVEMENT**

- New ways to make your home burglarproof
- Create a computer-centered home office ...and much more

14 COMPLETE PLANS INSIDE

- A sun
- Make
- that o
- ...an

PRINSENDAM

GREATEST SEA RESCUE EVER

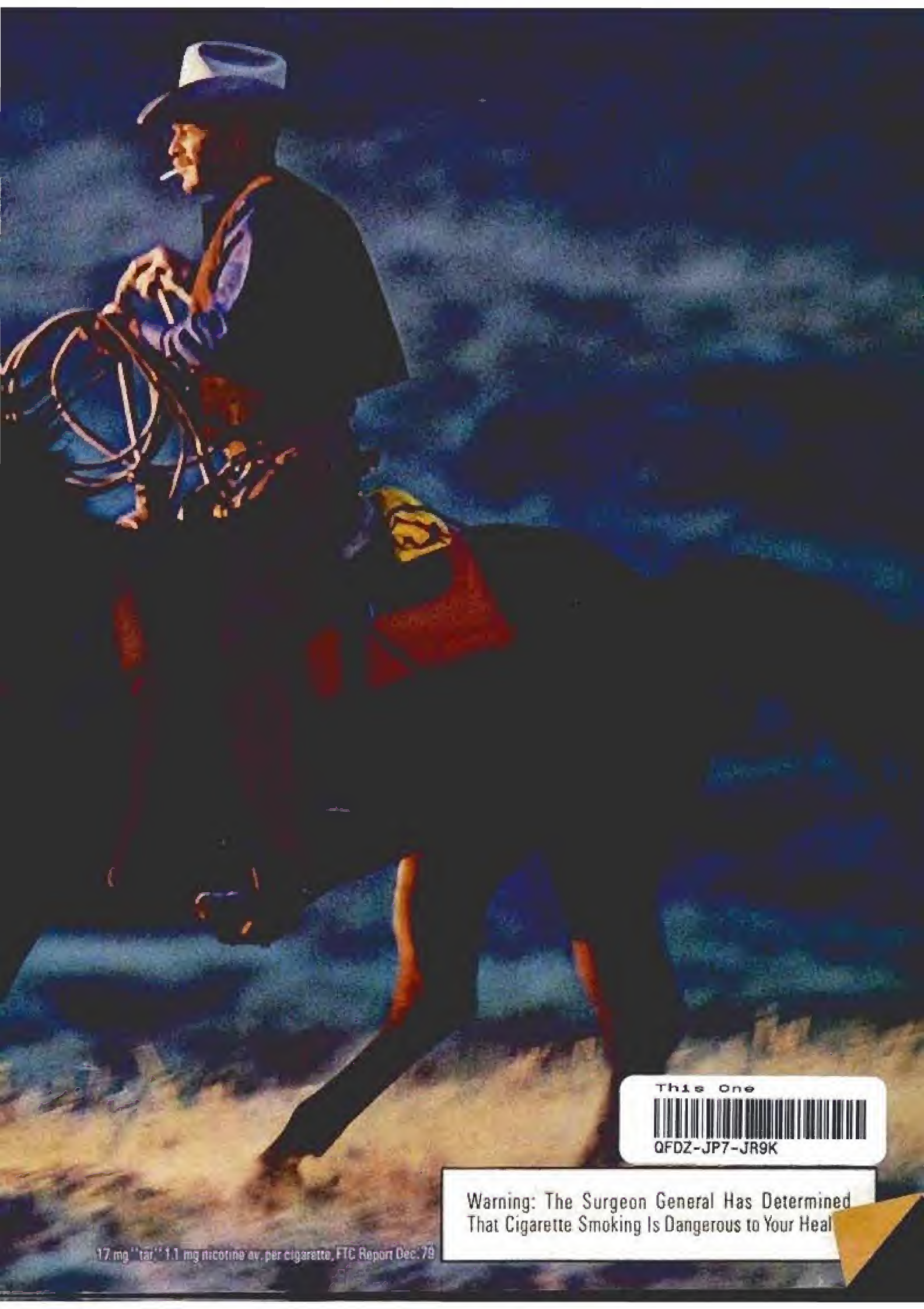
Heroes and survivors tell how it happened



**Come to where the flavor is.
Come to Marlboro Country.**



Marlboro Red or Longhorn 100's—you get a lot to like.



This One



QFDZ-JP7-JR9K

Warning: The Surgeon General Has Determined
That Cigarette Smoking Is Dangerous to Your Health

17 mg "tar," 1.1 mg nicotine av. per cigarette, FTC Report Dec. 79

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While other muffler companies make a lot of noise about their product, Walker® chooses to remain quiet. After all, the number one selling muffler in America should be quiet. Walker is so quiet, however, we could be under your car—and you might not even know it.

Walker mufflers are tested, retested and tested again to assure that they match the sound quality needed for your car.

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WALKER

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Walker Manufacturing
Division of Tenneco Automotive



On the cover

The dawn abandonment of the burning cruise ship *Prinsendam* sets the stage for one of the most challenging rescue missions in the annals of the sea. Story begins on page 102, featuring minute-by-minute accounts from heroes and survivors.

—PM painting by Ed Valigursky

Popular Mechanics

APRIL 1981

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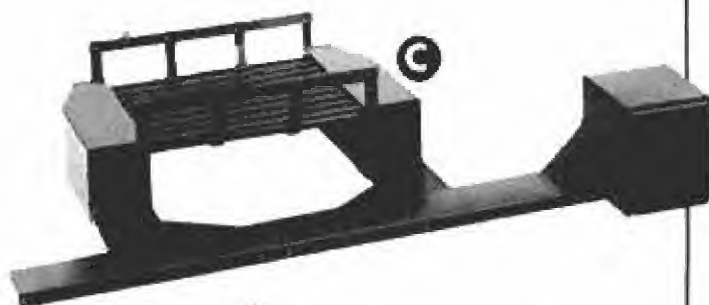
A

A Pendant fixtures for McGraw-Edison's Power-Trac light systems have been introduced by McGraw-Edison Co., 400 Busse Rd., Elk Grove Village, Ill. 60007. Lamp height can be adjusted by use of a detachable cord clip which holds a loop. The simple clip works through friction created by the fixture's weight. The lamp shown here is model No. L1534Ab; suggested retail price is \$84. The fixture is available in several styles with different shade shapes. Write to the manufacturer for information on local suppliers.



B

B The Gibson acrylic bar sink shown is one of two models that is offered by Kohler. Available in five colors, it measures 15 x 25 inches. The bar sink features three stainless-steel cups on one side of the basin and a hardwood cutting board on the other. All accessories are removable to facilitate easy cleaning. The maker claims that the durable, non-porous, stain-resistant acrylic makes the sink lightweight and consequently, extra easy to install. It costs approximately \$115 from plumbing suppliers who handle Kohler products. It is manufactured by Kohler Co., Kohler, Wis. 53044.



C

C Many new designs are now available in fireplace inserts. Heat exchanger No. 90H81 from Arvin comes with electronic integrated circuitry which controls the blower speed automatically. The fan's speed increases as the heat intensity of the fire rises. As a result, more heat is delivered to the room. The unit has 1½-inch-diameter, 14-gauge steel tubes and an exchanger with adjustable grates. It can be adapted easily to fit several fireplace sizes. The cost is \$174.95. Write to Arvin Industries Inc., Dept. PM 481, 1607 Central Ave., Columbus, Ind. 47201 for purchasing information.

D



D Door Dolly is a handy aid for anyone who has to work with, and handle, heavy doors or large panels by himself. In addition to helping you move doors, the dolly serves as a jig; it can be used to hold work in three different positions for planing, routing and hardware installation. Constructed of ½-inch tubular steel and 12-gauge steel plate, the dolly rolls on 5-inch-diameter wheels which allow easy movement over small debris and rough floors. Door Dolly is priced at \$95 and is available from the manufacturer, Johnson Door Dolly, 870 Diablo Rd., Danville, Calif. 94256.



IT'S FUNNY HOW OFTEN
THE COMFORTS OF HOME INCLUDE RED.

JOHNNIE WALKER® RED
THE RIGHT SCOTCH WHEN ALL IS SAID AND DONE.

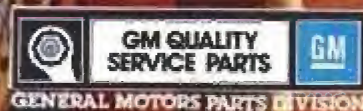


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POWER



TO GO.



The Honda EM-500 portable generator is really going places: The mountains. The lake. The desert. Out to sea. Anyplace people need to power camping accessories. Charge their boat or RV batteries. Run small tools or appliances. Or shed some light on emergencies.

TRAVEL LIGHT

You can carry the EM-500 anywhere. It gives you a maximum 500 watts of power in a lightweight 40 lb. package about the size of a small portable TV.

The EM-500's engine is a Honda. Designed and built by the people famous for engine innovations. And like all Honda engines, it's fuel efficient. It'll run up to 4 hours on half a gallon of gasoline.

Standard features include a cast iron cylinder sleeve for engine durability. An automatic voltage regulator for steady output. A throttle control frequency meter to help pinpoint 60 cycles. And a DC charging cord.

THE STRONG, SILENT TYPE.

The EM-500's superb engineering design provides quiet operation. While an automatic choke and capacitor discharge ignition make starting fast, easy and reliable.

Refueling is also easy because with the EM-500's 4-stroke engine you don't need to pre-mix fuel. And because it has a spark arrestor built right into the muffler, the U.S. Department of Agriculture has approved the EM-500 for use in National Parks.

Whether you need power in some far away place, or just want emergency auxiliary power in your home, you'd have to go a long way to beat the Honda EM-500. If you'd like to see one for yourself, or simply ask some questions, stop by your nearby Honda Generator dealer. To find the one nearest you, just look in the Yellow Pages, or call toll-free 1-800-228-2056, ext. 640, and in Nebraska, 1-402-571-4900, ext. 640.



IT'S A HONDA

© 1981 American Honda Motor Co., Inc. For optimum performance and safety, we recommend that you read the owner's manual before operating your Honda Power Product.

PM WORKBENCH

PM EXAMINES PRODUCTS AND SERVICES

Dollhouse electric wiring kit

You can wire new or existing dollhouses with this electrical wiring kit, so your kids can actually turn on the lights. The wiring is adhesive-backed; run it from one room, around the front edge of a wall, to an adjacent room. Later, conceal the



Wiring kit has material for a six-room dollhouse, instructions and a test bulb.



Electrical wiring (arrows) has adhesive backing for easy, stick-on application.

wire with paint or wallpaper. Starter kit No. 1000-1 (\$34.95 postpaid) has material to wire a six-room house: plug-in transformer and lead-in wire, electrical wiring, pilot-hole punch, test bulb, junction splice, brass brads and instructions. Bulbs and decorative lights are also sold by Cir-Kit Concepts, 608 North Broadway, Rochester, Minn. 55901.—P.S.

Crossing the threshold

Two new oak thresholds are now available for use in construction, remodeling or repair work. The hardwood thresholds will withstand heavy traffic. Dubbed "Low Boy" and "High Boy," they measure $\frac{3}{4}$ x $3\frac{1}{2}$ x 37 in. and $1\frac{1}{4}$ x $3\frac{1}{2}$ x 37 in., respectively. At lumberyards, the Low Boy is priced at \$4.49; the High Boy is \$5.49. They are manufactured



These hardwood thresholds can withstand the wear and tear of heavy everyday usage.



The cross sections of thresholds are Low Boy and High Boy (immediately above).

by Macklanburg Duncan Co., Box 25188, Oklahoma City, Okla. 73125.

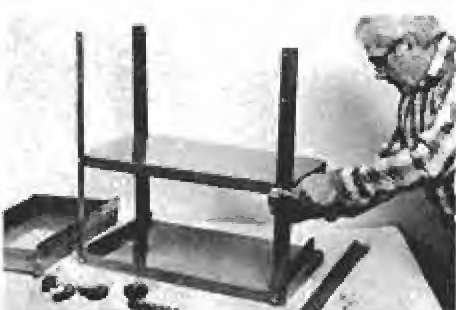
—Rosario Capotosto

You can take it with you

This heavy-gauge steel tool cart is superhandy for garage or workshop use. Shelves and a drawer provide ample storage space for a variety of



Cart, after it's been loaded with tools, can be conveniently rolled to the work area.



Metal cart comes knocked down, but it is easy to assemble, with the bolts supplied.

portable power tools. A lock eye lets you padlock the drawer. Scotty cart is \$154 from Shure Mfg. Corp., 1601 South Hanley Rd., St. Louis, Mo. 63144.—H.W.

Kitchen and bath design guide

Twelve new kitchen and bath designs are described in a 64-page, color booklet, *Official Kitchen and Bath Color and Design Guide*. It was developed jointly by Ralph Wilson Plastics Co., Magic Chef Inc. and Kohler Co. Send \$3 to: Design Guide, Wilsonart, Dept. PM, Box 2256, Fort Worth, Tex. 76113.—H.W.

Epoxy wood repair

Bondo Epoxy Wood Repair is a two-part, putty-like formulation used for wood repair and restoration. The cured material is ideal for rebuilding



Knead equal parts of the two components to a uniform color. The repair is nontoxic.



You can easily build up damaged spot by shaping epoxy with fingers.

antiques, fixing toys and filling holes and cracks. Knead equal parts of each component together with your fingers until color is uniform. Apply material and shape it as needed. After 12 hours, you can tool, sand, stain or paint it. A 1-oz. pack is \$2.19 from Dynatron/Bondo Corp., 2160 Hills Ave. N.W., Atlanta, Ga. 30318.—Rosario Capotosto

If you've come across a new product with some special features, let us know about it. Write to PM Workbench, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019.



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If you're in the market for a pickup, why not pick one you can be proud of. A GMC. Our restyled 1981 pickups are more aero-

dynamically styled than last year's models. And have just as much carrying capacity.

Like all GMC's, our vans and pickups are covered by a Three-year Perforation from Corrosion Limited Warranty. Exhaust system components are not included. Ask your GMC dealer for details on other limitations.

Depending on your job requirements and the model you choose, both vans and pickups are avail-

able with either the standard inline six or optional V-8 engines.

Ask your dealer about buying or leasing a GMC. Or a lot of GMC's, for that matter. And discover what a pleasure it is to work with them.

PICKUP

25 EST
HWY

19

EPA EST
MPG

VAN

25 EST
HWY

18

EPA EST
MPG



REMEMBER: Use estimated mpg for comparison. Your mileage may differ depending on speed, distance, weather. Actual highway mileage lower. Estimates lower in California.

GMC pickups are equipped with GM-built engines produced by various divisions. See your dealer for details.

TRUCKS ARE WHAT WE'RE ALL ABOUT.

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in the KOOL*

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100 First Prizes

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Each entry must include either one empty pack of any style of KOOL cigarettes or the name of your favorite KOOL cigarette style hand-printed on a separate 3" x 5" piece of paper. NO PURCHASE NECESSARY.

2. Enter often, but each entry must be mailed separately. Entries must be postmarked by June 15, 1981 and received by June 30, 1981. No postcards, metered mail, or mechanically reproduced entries will be accepted.

3. Winners will be determined by a random drawing by an independent judging organization whose decisions are final. The odds of winning will be determined by total number of entries received.

4. Winners will be notified by mail. To obtain a list of winners, send a stamped, self-addressed envelope to KOOL Winners List P.O. Box CC, Chicago, IL 60677, between August 1, 1981 and August 31, 1981.

5. All prizes will be awarded, subject to the following restrictions: All winners and all guests of first prizewinners must sign a release/indemnity agreement to win a prize. No cash or other substitution for grand prize. The date, time and location of balloon rides for first prizewinners must be approved by B&W based on balloon availability and will be subject to change due to safety and logistical factors and to weather and any other factors beyond B&W's control. B&W has until August 31, 1982 to award first prizes. If for any reason any first prize-winner has not taken the balloon flight by August 31, 1982, Brown & Williamson shall have the option of awarding the sum of \$100 to said prizewinner in lieu of the balloon flight.

6. Winners must give notice to Brown & Williamson of their acceptance of their prize by August 15, 1981. Only one prize per family. Prizes are not transferable prior to award. Liability for taxes is the sole responsibility of the winners.

7. Sweepstakes is open to U.S. residents who are 21 years of age or older except employees and their families of Brown & Williamson Tobacco Corporation, its subsidiaries, affiliates and advertising, promotional/publicity agencies, and H. Olsen & Company. Void wherever prohibited or restricted by law. Prizewinners living outside continental United States may be required to travel to U.S. mainland at Brown & Williamson's expense.



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State _____ Zip _____ Phone _____

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My present brand is _____



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2. Irwin No. 22 "Micro-Dial" hand brace expansive bit bores 35 standard holes $\frac{1}{16}$ " to 3". Just dial the size you need. No. 21 bores 19 standard holes, $\frac{1}{16}$ " to $1\frac{1}{2}$ ".
3. Irwin 62T Solid Center hand brace bit delivers double-cutter boring action. Medium-fast screw pitch. Balanced cutting head. 18 sizes, $\frac{1}{16}$ " to $1\frac{1}{2}$ ". Available individually or in sets.



You can easily bore holes up to $1\frac{1}{2}$ " with the Irwin Speedbor "88." This is the wood bit that cuts clean, fast, accurately. Puts more boring power at the working end of your $\frac{1}{4}$ " electric drill.

Irwin's exclusive hollow ground point has the power to start holes fast. Sharp spade-type cutters power through any kind of wood. $\frac{1}{4}$ " shank chucks perfectly.

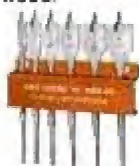
Workshop special

Set of 6 Speedbor "88" bits with metal hang-up rack. Sizes $\frac{1}{16}$ ", $\frac{1}{8}$ ", $\frac{3}{16}$ ", $\frac{1}{2}$ ", $\frac{3}{4}$ ", 1 ".

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NOTES FROM THE EDITOR

John A. Littleton

"I got a sense of the vulnerability of the shuttle when I handled a replica of one of the 31,000 tiles protecting the fragile aluminum skin," reported Gurney Williams after a trip to NASA's Washington office to get this month's story. Few parts of the shuttle have caused more frustration as builders tried to get the heat-resistant tiles to bond.

"NASA told me the problems were licked," Gurney went on. "But the tile I held—which had not been sealed the way an actual tile would be—was chalky and soft. I could easily make scratches on it with a fingernail, and when I tapped it on the desk, it rang like a china plate. Those astronauts riding the shuttle rely on some delicate gear."

The tiles, indeed, rank up at the top of NASA's "criticality list." See page 93 for the nine critical components that must not fail.

We have a new publisher here at Popular Mechanics. Now, I realize that such an announcement creates considerably more stir within the office than it does, say, in Dubuque.

But hold on a minute, Dubuque. You and the rest of the folks out in Iowa may be interested in a couple of coincidences.

This magazine was founded by a native Iowan. He was Henry Haven Windsor, born in a log cabin into a Congregational minister's family. While city editor of the Marshalltown *Times-Republican*, he conceived the idea for a magazine devoted to the wonders of new technology. In 1902, he started PM in Chicago.

Now comes Dan Coleman, our new publisher, who was born and raised on a farm near Clare, Iowa. Dan went 'way out east to Indiana to attend Notre Dame, and eventually came to the PM advertising sales staff 24 years ago. Most recently, he has been director of advertising and associate publisher.

To complete the picture, we still have an Iowa preacher's kid here, too. That's my own particular role. So now PM is back in the hands of prairie folks—right on Broadway, no less!

For the past 17 years, Joseph Kern (not an Iowan but a Bostonian, by the way) has been publisher, and the excellent growth of PM under his direction will be a tough record for Dan to match. Joe can enjoy his retirement more, knowing how well PM fared during his years.



Joseph Kern (left) and Dan Coleman at a recent advertising sales conference.

Now NRI takes you inside the new TRS-80 Model III microcomputer to train you at home as the new breed of computer specialist!

NRI teams up with Radio Shack advanced technology to teach you how to use, program and service state-of-the-art microcomputers...

It's no longer enough to be just a programmer or a technician. With microcomputers moving into the fabric of our lives (over 200,000 of the TRS-80™ alone have been sold), interdisciplinary skills are demanded. And NRI can prepare you with the first course of its kind, covering the complete world of the microcomputer.

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cian can test and debug systems quickly and easily.

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NRI training is hands-on training, with practical experiments and demonstrations as the very foundation of your knowledge. You don't just program your computer, you introduce and correct faults...watch how circuits interact...interface with other systems...gain a real insight into its nature.

You also build test instruments and the NRI Discovery Lab, performing over 60 separate experiments in the process. You learn how your trouble-shooting tools work, and gain greater understanding of

the information they give you. Both microcomputer and equipment come as part of your training for you to use and keep.

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(TRS-80 is a trademark of the Radio Shack division of Tandy Corp.)

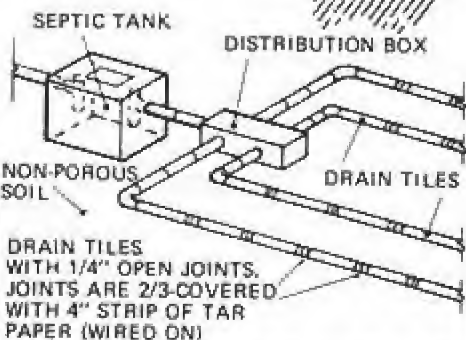
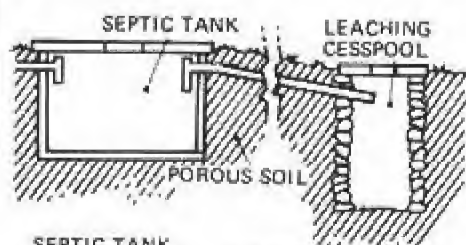
HOMEOWNERS' CLINIC

QUESTIONS ANSWERED

Alternate to septic tank

What can I use for a sewer system other than a septic tank? Due to our high water table and heavy concentration of rock, our residential area faces costly improvements if we are to stay with the standard septic system. Also, how can I finance this type of program?—William F. Craig, Lake Hopatcong, N.J.

Aside from municipal sewerage disposal, septic tanks and cesspools are the only methods I know of. In most cases, health codes insist on septic tanks for collection of solids. Both the leaching cesspool and the tile field allow the soil to absorb the liquids from the tank. In some areas, dynamite must be used to remove



In porous soils, septic tank combines with leaching cesspool (top). In nonporous soil, use septic tank and tiles.

rock, or to break up extra-heavy clay soils. My local bank says it would finance this type of work as it would any other home-improvement loan.

The following information is intended only to advise the layman of the principle of a septic system. The construction of such a system is a job for a pro. Capacity (size) of the tank is related to the number of members in the family (number of bedrooms and toilet fixtures should also be considered).

In somewhat porous soil, the septic tank effluent (liquid) may be piped to a leaching cesspool. This is a well-like structure that is lined with either loosely laid stones or concrete blocks with their core holes placed horizontally. No mortar is used, as the liquid must leach into the sur-

rounding soil through the joints or cores.

In nonporous or clay soils, quite often tile fields must be used. Here the effluent from the septic tank flows to a distribution box. This is a device that allows flow through more than one pipe to tiles laid with the joints open. The tiles are placed on, and partially backfilled with, stone or gravel. This allows gradual seepage and disbursement into the soil.

Excavation for the tile field is usually deeper than required for the tiles themselves. The stone or gravel provides a bed for the tile, and the backfill is about 1 foot above the pipe. Soil brings the fill up to grade. The open joints are covered with strips of tarpaper to keep the gravel or stone from filling the tiles.

The pitch of the tiles is important. If it is too steep, the liquid will flow rapidly to the end of the line without proper leaching through the open tile joints.

Tapping outside air

John Strange, Munster, Ind., has a fireplace half a flight below grade, and H.M. Glerom, Henrietta, N.Y., has a fireplace on grade. Both fireplaces have glass doors, but their owners want to tap the outside air for combustion, rather than using heated inside air.

In case you missed it, "Having and Eating Cake" (*Homeowners' Clinic*, page 70, June '80) covers both problems. The Airpliance Venting Kit we discussed supplies fresh air for combustion to stoves and fireplaces. It costs about \$80 from Basic Energy Conservation Services, 1296 Hudson Rd., St. Paul, Minn. 55106. As it feeds air in through ducts, it should meet both of your requirements. The manufacturer says that the 4-inch-diameter ducts may be used for distances up to 25 feet.

Dressing an asphalt driveway

Vallie M. Clayton of Etowah, Tenn., dresses his 10-by-60-foot asphalt driveway in the following manner. He scatters about 20 pounds of port-

land cement on it, then sprinkles just enough water on it to wet the cement.

He follows this by brushing the surface with a broom. He writes that the result is a beautiful white surface that lasts about four years. Clayton claims it will resist oil and gasoline stains, and that he's been doing this for about 20 years with great success.

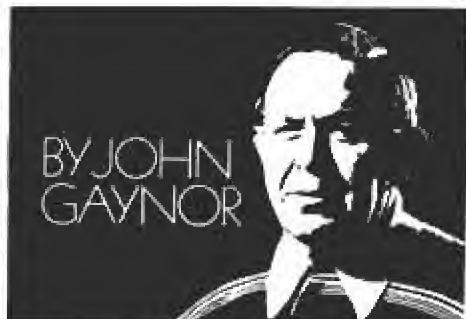
The Asphalt Institute confirms V.C.'s theory, with reservations. It says that this technique can raise the asphalt's resistance to stains, if the cement isn't put on so thick that it flakes off in chips. Some road repair gangs, when completing an asphalt patch, "dust" the patch with a burlap bag half-filled with cement, much as women use powder puffs. I'll have to take Clayton's word as to the degree of stain resistance attained.

No ceiling heat

We have a nine-room house heated with electric ceiling heat panels. Each room has its own thermostat. We get no heat in the dining room. Lately, there hasn't been heat in the family room.

According to the local utility company, we have the correct voltage and amperage. As the system is 20 years old, servicemen are reluctant to investigate my problem. However, I have some experience in the electrical field. Is there some way I can check this out myself and save some money?—Joseph L. Morrison, Salisbury, N.C.

In "Locating a Cable Break" (*Homeowners' Clinic*, page 11, June '79), we outlined the method and approximate cost of testing equipment for solving your problems. You should have no questions, but you may want to get advice from a professional who actually installs these systems before you try your own hand at this project. **PM**



BY JOHN GAYNOR

Do you have a home maintenance or repair problem? Send it to *Homeowners' Clinic*, *Popular Mechanics*, 224 West 57th St., New York, N.Y. 10019. Letters cannot be answered individually, but problems of wide interest will be discussed in this column. For more home repair and maintenance help, get *PM's Home Care Guide*, \$4.95 postpaid. Send order(s) to *PM*, Dept. HCG, Box 1014, New York, N.Y. 10019.

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Hiram Walker's unique, light-tasting whisky earned its reputation as the finest whisky in exclusive clubs from the time it first appeared. That's how it became "Club Whisky."

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*See package for details.

HINTS FROM READERS

Wingnut security



Bore a hole large enough to hold a small lock in the free end of the bolt.



With the lock setup, an unauthorized individual cannot remove the wingnut.

Prevent unauthorized removal of nuts or wingnuts, such as those on bike carriers attached to cars. Bore a hole large enough to accommodate a small lock in the end of the bolt. Now, to remove the wingnut, you need the key to the lock.—*Lane C. Sanders*

Spillproof cup

When using a paper cup to hold a small amount of liquid, you can prevent accidental spills with a tip-proof stand. Simply cut the upper half from a similar-size cup, invert it, and insert the cup in the "stand."—*G. Forsbee*

Twine dispenser

To keep a ball of twine from rolling as you use it, place it under a flowerpot that's been turned upside down. Feed the free end of the twine through the drain hole.—*Lane Olinghouse*

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HOW CAN ONE SMALL COMPUTER PROTECT MY WHOLE BUILDING?

Guardex 8000 Alarm System works on the principle of audio discrimination. This, put simply, is the process of electronically separating normal everyday sounds, such as voices, telephones, etc., from break-in type noises such as breaking glass, prying metal, or forcing a door open. The Guardex 8000 protects one story homes and offices up to 2000 square feet and open commercial buildings up to 10,000 square feet. The Guardex 9300 with wireless remote sensor capability is available for multi-story homes and offices or single story with more than 2000 square feet. Call the factory for more detailed information.

TURNS ON LIGHTS AUTOMATICALLY

When the first break-in type sound is detected, the system will instantly turn on lights, radio, or other electronic equipment that you have plugged into the back of the alarm. These lights or other equipment will remain on for a period of five minutes, then automatically turn off.

POWERFUL ELECTRONIC SIREN

The Guardex 8000 alarm is equipped with a loud built-in siren. If during the five minute period the lights or other electronic equipment has been activated, a second break-in sound is detected, (it can be only a second or two after the first break-in sound) the built-in siren will start blasting for 90 seconds. At the end of approximately 90 seconds the siren will shut off and the alarm listens again. If another break-in sound is heard, the siren will come on for another 90 seconds. If no other break-in sound is detected, the siren will stay off and at the end of the five minute period the lights will shut off and the alarm instantly resets.

The rear control panel contains two standard AC plug receptacles for a table lamp, spot lights, radio, etc., terminals for connecting optional outside siren and back-up battery (not included); entry delay time control and sensitivity control.



The Guardex 8000 Alarm System is walnut grained and disguised to look like a small stereo speaker (6 1/4" x 9 1/4" x 8") and weighs less than 6 1/2 pounds.

EXIT AND ENTRY DELAY

The Guardex 8000 alarm has a built-in exit delay allowing you approximately one minute to lock up and leave the building before the alarm is armed. When you enter your building you may find that just your normal entering sounds activate the siren. You may delay it from starting for up to 30 seconds by turning up the siren entry delay control.

BATTERY BACK-UP

Burglars rarely cut power. However, to give you total protection from a burglar and possible power failure, our alarm has provisions for a battery back-up. (Batteries not included). 12 volt lantern batteries are available at most hardware stores.

THE BURGLARY PROBLEM

The F.B.I. statistics show that at the present rate, one out of every four Americans are going to be burglarized. That is not a very pleasant fact, but it is true. You have a greater chance of being burglarized than being a victim of a fire or automobile accident. The time is now to help protect yourself and your valuables with a Guardex 8000 alarm system.

OUTSIDE SIREN

The Guardex 8000 alarm is equipped with a loud, built-in siren, but if you desire an additional siren to mount outside or in an area away from the main alarm, they are available with 50 feet of wire for \$24.95. (Connecting terminals are provided on the back of the alarm).

30 DAY NO RISK TRIAL

This is your opportunity to purchase an alarm system directly from the factory for only \$199.95. Try it in your home or business for thirty days without risking one cent. Put our Guardex 8000 alarm to your own test. See for yourself! It will protect every window and door from break-in. If you are not completely satisfied, return the alarm within 30 days for a complete refund. To order your Guardex 8000 alarm, CALL TOLL FREE to charge your credit card or send your check to Guardian Electronics, Inc. in the amount of \$199.95 plus \$3.50 postage and handling. If you want the optional outside siren, add \$24.95 (California residents add 6% sales tax.)

(If you require more information, call during California business hours, Monday - Friday).

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THE PM GARAGE

CAPSULE REPORTS ON NEW AUTO PRODUCTS

Super tire iron

The Conti Super Wrench can be appreciated by anybody who's ever struggled with a tire change.

The tool consists of an 18-inch corrosion-resistant steel bar connected to a large, wingnut-backed, $\frac{1}{2}$ -inch socket drive. The wingnut socket shaft locks in place for tightening



Tire iron is more compact than conventional tool, can also be used on other bolts.

purposes. When unlocked, it will free-spin to take off or replace lugs. There's no need to reposition the entire wrench after each turning stroke.

I found the Super Wrench to be very useful for chores other than tire changes. It works as a handy breaker bar for stubborn nuts and bolts. The Super Wrench costs \$17 and is available from Conti Enterprises Corp., 2023 119th St., College Point, N.Y. 11356.—Joel Breault

Siphon pump

Have you ever siphoned fuel and ended up with a mouthful of no-lead? I have. But, thanks to a neat new pump, Siphon-Mate, my gasoline-mouthwash days are over.



Plastic pump works as either siphon or pump; handles water, blige, fuel or oil.

Siphon-Mate is a plastic pump that can handle any pumping or siphoning chores: water, fuel, oil or whatever. It works as a conventional pump, or, simply by pulling on the handle once, will work as a siphon. It has 7 feet of intake hose and 3 feet of discharge hose. It's \$13.95 (plus \$1.50 postage and handling) from Beckson Manufacturing Inc., Box 3336, Bridgeport, Conn. 06605.

—T.A.

To see again

Gas stations don't clean windows anymore. If you like to see where you're going, but aren't fond of carrying paper towels and jugs of fluid in the trunk, try Superwasher.

One side of the head has a squeegee and the other a sponge covered with netting to remove stuck-on dirt and bugs. A 12-ounce squeeze bottle, which holds water or cleaning fluid, fits into the head.

The Superwasher costs \$2.49 and is available at mass merchandisers,



Windshield washer comes with its own 12-ounce liquid dispenser attached to head.

auto stores and even some drug-stores. For more information, contact Atlas Textiles, 1719 East 39th St., Cleveland, Ohio 44114.—T.A.

Shock-absorber tool

I've changed shocks the hard way—with pliers and wrenches—and the Kastar Front Shock Absorber Tool Set is the easy way to go. It saves you time and some skin off your knuckles, since the upper front shock retaining nuts are recessed and difficult to reach.

The Kastar tool has a deep socket to reach down onto the shock shaft and grab the nut. An L-shaped handle with two different-sized, oval-shaped sockets is provided to fit within the $\frac{1}{16}$ -inch socket and hold the upper end of the shock piston rod. Hold the handle and loosen or tighten the hex nut with a $\frac{1}{4}$ -inch



New tool speeds the removal of hard-to-reach shock-absorber retaining nuts.

open-end wrench. The set is \$4.50 at auto parts stores. You may write to the manufacturer, Kastar Inc., at Station Rd. and Sunrise Hwy., Bellport, N.Y., 11713.—Joel Breault

Keep the fires burning

Portable heaters are handy to warm up an unheated garage or get a cold diesel engine started.

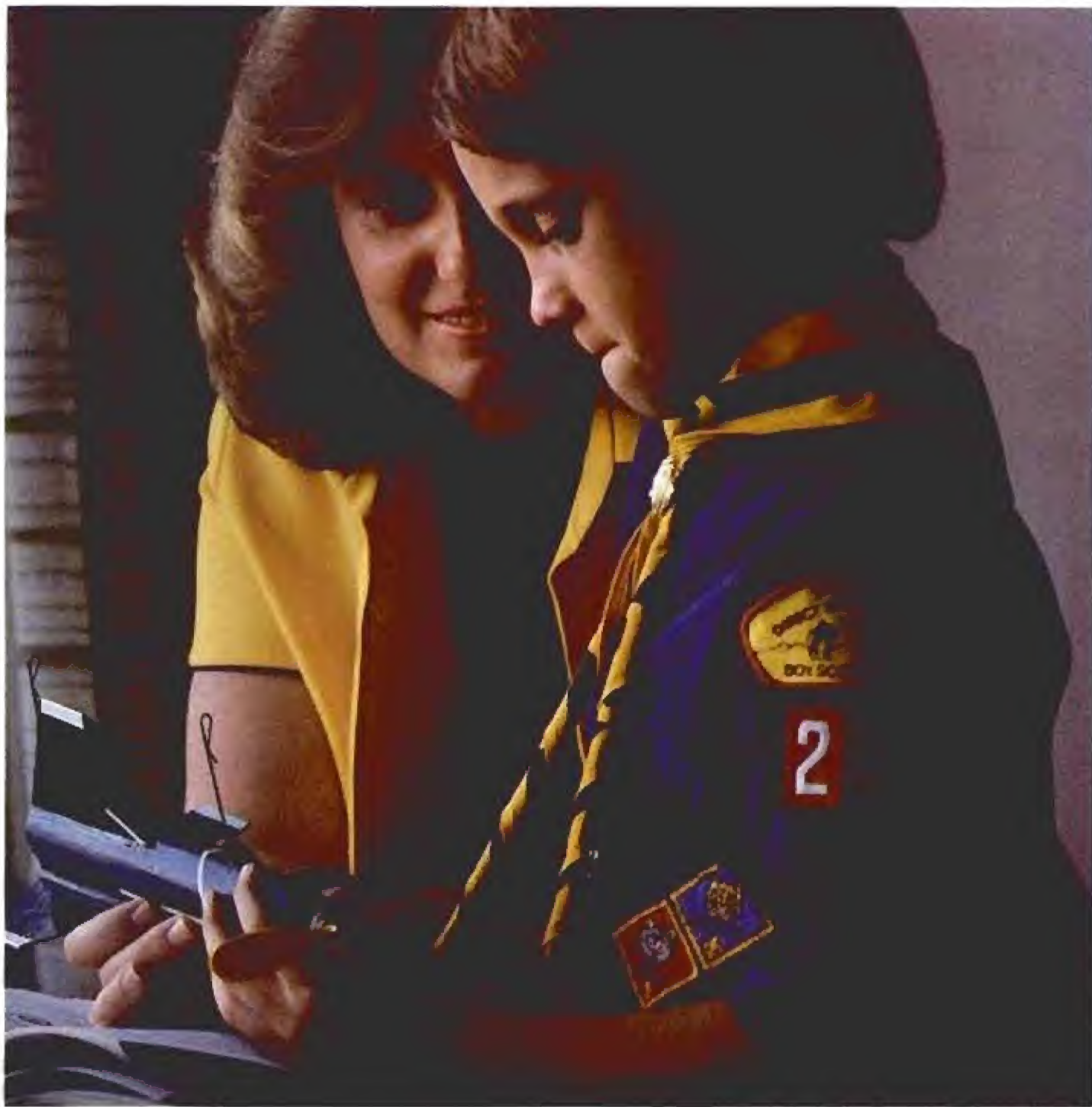
The SureStart Preheater was designed for heavy-duty outdoor use and works from a propane cylinder. One cylinder provides 45 minutes of



Portable heater works with propane cylinder, providing heated air at up to 325° F.

325°F. air, which is blown out of the 6-foot-long flexible duct. With two cylinders aboard, the entire unit weighs only 22 pounds and comes in its own storage case.

It's \$325 from Wilbur Industries, Southwest Harbor, Me. 04879. A free brochure is available.—T.A.



Important talks in the Middle East

Statesmen aren't the only people in the Middle East who have important talks.

In Saudi Arabia, where we live, Cub Scouts have important talks with Den Mothers. Car owners have important talks with mechanics. Batters have them with umpires. And schoolgirls have *lots* of them with other schoolgirls.

We're Aramco, the Arabian American Oil Company. There are 13,000 North Americans in Saudi Arabia with us. And even though you hear a

lot of news about Saudi Arabia, there are things that might surprise you about our lives there.

1. We're doing something important. Aramco produces more oil than any other company. Badly needed oil. Including about 15 percent of the oil the U.S. imports.

2. Aramco is working on some *incredibly* large energy projects. And on huge communications networks, electric utilities, and more.

3. Our people are glad to be in Saudi Arabia with Aramco. They came

for excellent pay and professional challenge.

4. After 46 years in Saudi Arabia, Aramco is still growing fast. So is the number of interesting and rewarding jobs we offer.

5. The model airplane took off on the first try.

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You can count on Sears to make sure it will do the job

"Will those paints stand up to the weather?" is one of thousands of questions about thousands of products that the Sears Laboratory answers every year. Founded in 1911, it is among America's biggest and oldest labs devoted to testing consumer products.

In our photograph you see a few of some 20,000 paint panels taking a beating from Florida weather at Sears laboratory in Fort Myers.

Which paint best resists mildew in the humid Florida climate? Which fades the least under the scorching Florida sun?

No new paint appears on the shelves at Sears until the lab has tested formula after formula—sometimes for as long as *five years*.

All this is on top of extensive testing conducted in the north, by the manufacturer, under Sears watchful eye.

Other products, other tests. Every day, Sears electrical, chemical, and mechanical engineers turn dozens of products upside down and inside out. Sears laboratories in Chicago and Fort Myers test

over *ten thousand* products a year. At the Chicago lab you might see machines slamming weights onto seats of children's swings to learn which of a variety of plastics is strongest. You might see dozens of new fabrics undergoing tests for color fastness, shrinkage, and flame resistance.

You'd see products being tested for durability. For convenience. For performance.

It's all part of Sears commitment to offering you consistently good values. For over 50 years Sears has made this promise:

*Satisfaction guaranteed
or your money back.*

Thanks in large part to the work of Sears laboratories, many millions of people have been satisfied shopping at Sears.

Sears

© Sears, Roebuck and Co. 1989

◀ A Sears technician checks the effects of Florida sun and humidity on samples of potential Sears paints. There are some 20,000 panels, each with up to four paint samples, many under test for five years.

DETROIT LISTENING POST

Two for '82

Our roving cloak-and-dagger photographer caught a pair of new GM models while they were undergoing tests in the desert.

What looks like an Oldsmobile Omega is GM's new intermediate sedan, based on the current X-car chassis and wheelbase. This car is eight inches longer than the current X-bodies and provides more interior room. This front-drive A-body will replace the current rear-drive cars (Malibu, LeMans, Cutlass, Century) about this November.

The second model, a pickup, is sized between the LUV truck and



All-new Chevrolet pickup truck is smaller than current truck and has 1.8-liter Four.



New Olds A-body intermediate will have X-car wheelbase and power train for '82.

the current full-sized Chevy pickup. It will probably carry the same 1.8-liter Four that will be introduced in the upcoming J-cars.

New small Lincoln coming

Successor to the Lincoln Versailles (which was discontinued for '81) is a new small Lincoln Continental on the rear-drive Fairmont/Zephyr/Granada/Cougar platform. It's being readied for fall '82 introduction.

About 200 inches long and 3,400 pounds, the car has a Lincoln-style nose and rear-end "bustle" similar to those on Cadillac's Seville and Chrysler's Imperial. The power train is said to be Ford's fuel-injected five-liter V8 with four-speed overdrive automatic transmission, which should give it a competitive EPA city fuel-economy rating near 20 mpg.

Ford designers, meanwhile, are working on more aerodynamic body styles for the larger Lincolns and Marks, scheduled for '83. An all-new series of smaller, front-wheel-drive Lincoln luxury cars are in the planning stages for '86 or so.

Fwd GM wagon spotted

Rumor has it that a medium-sized fwd station wagon prototype is being tested in the new wind tunnel at GM's Warren, Mich., Tech Center. This could mean that GM is planning an X-car wagon version to compete with Chrysler's nice, efficient K-car wagons.

The A-car wagon, however, will maintain its rear-drive configuration for '82, so this smaller wagon would be an '83 or '84 addition.

Chrysler fwd sports car

If it's not delayed by cost-cutting measures, Chrysler will introduce a K-car-based, 100-inch-wheelbase, four-seat sports car in '83, just in time to counter Pontiac's plastic-bodied, mid-engine two-seater. The Chrysler sportster is said to be a handsome hatchback with lots of rear glass, powered by the new 2.2-liter four-cylinder with five-speed transaxle available.

In other Chrysler news, president Lee Iacocca has said that a rear-drive mini-truck has been canceled, but that plans for a pair of fwd pickups (one carlike, one more trucklike) are still on tap for '83 or '84. A new four-speed overdrive automatic transaxle is also under development for '84-model fwd cars and trucks.

Lightweight Jeeps for '83

American Motors is readying an all-new series of resized, lightweight Jeep vehicles for '83, which will be powered by fuel-efficient, turbo-charged, four-cylinder gas and diesel engines. The new AMC/Renault jointly developed, domestically built, fwd small car, and a redesigned rear-drive Concord and Eagle series are also slated for '83.

More future GM small cars

The 40-mpg, 92-inch-wheelbase, fwd, S-car minicompact, scheduled for European introduction in 1983, will likely be assembled here as well for '84. It will have a standard-equipment three-cylinder engine.

Inside GM, there's talk of a still-smaller, two-passenger U-car—the

product of one of several under-2,000-pound car programs. This little commuter could be ready for the '85 model-year.

Talking dashboards

National Semiconductor Corp. says that "more than one auto manufacturer" will offer its Digitaltalker human-voice-like warning system as an option in certain cars as early as this fall. The NSC electronic Digitaltalker converts signals from sensors monitoring such things as fuel and brake-fluid levels, oil pressure, charging system, even tire pressures, into voice warnings via the car's radio speakers.

The first talking dashboard appears on Datsun's '81 luxury 810 models, but that system is just a pre-recorded message that alerts you to headlights left on.

By next year, NSC's electronic synthesizer could be telling you to "Please check your oil."

"Better Ideas" book for women

Henry Ford II's daughters, Anne and Charlotte, have written a book aimed at making life easier for women motorists. *How to Love the Car in Your Life* is available at Ford and Lincoln-Mercury dealers and it's part of Ford's overall program directed to the automotive requirements of women.

According to Walter Hayes, Ford's new director of public affairs, females will figure prominently in Ford's future marketing plans. According to the company's surveys, women make the final choice in 40 percent of new-car purchases. As part of Ford's marketing plan to attract ladies to showrooms, Ford is sponsoring Lyn St. James, a woman driver, in the IMSA Kelly Girl Challenge. She'll be driving a factory-prepared Mustang.



WHEN YOU'VE GOTTA RELY ON YOUR CAR, RELY ON HARDWORKIN' AC-DELCO PARTS.

AC-Delco. They're the hot-firin', cold-crankin', road-handlin', dirt-fightin', hardworkin' replacement parts for your car.

For more than 50 years, hardworkin' people have relied on AC-Delco parts. In their cars. Trucks. Boats. Motorcycles.

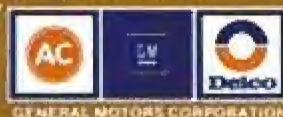
It's the one name they look to for just about everything — for just about anything that moves.

There's hot-firin' AC Fire Ring Spark Plugs. If your spark plugs are misfiring, a tune-up and a fresh set of ACs can help improve mileage. Big Delco Shocks.

Maintenance-free Delco Freedom II Batteries for powerful starts. And rugged

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AC-DELCO WORKIN'



A man wearing a black cowboy hat, a white tuxedo shirt with a black bow tie, and a black tuxedo jacket. He is smiling and has his hands near his waist. The background is a solid orange color.

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APPLIANCE CLINIC

QUESTIONS ANSWERED

Manganese management

My dishwasher has turned black and some of my dishes are stained. The plumber says it's from manganese in the water. I've tried vinegar, tub and sink jelly, and citric acid without results. What do I try next?—Jack Schnipper, Monroe, N.Y.

You were on the right track with the vinegar, although your solution was probably too weak. Acetic acid, similar to that in vinegar, should dissolve the manganese buildup. Acetic acid is not available in many hardware stores, but chemical supply houses carry it. Look in your Yellow Pages under "Chemical Plant Equipment & Supplies." Try progressively stronger solutions on the dark spots. Wear rubber gloves when working with the acid and flush everything with lots of water afterward. A handful of baking soda thrown into the dishwasher and swabbed over everything else that has come in contact with the solution will also help to neutralize the acid after the stains are out.

Washer warmup

In "Slow-Starting Agitator" (Appliance Clinic, page 38, Oct. '80), James Enslow described his problem with a sluggish clothes washer in an unheated basement. We had the same problem and we used the following approach.

Let the washer fill with hot water. Then stop the wash cycle. Wait about 15 minutes while the heat from the water warms the agitator shaft, the surrounding housing of the transmission and the lubricant. Now start the wash cycle. The machine should operate normally.—Alex Lupinski, Scranton, Pa.

Thanks, Alex, for sharing your solution.

Closed-door policy

The automatic door closers don't shut the doors tightly on our Whirlpool refrigerator, which is model No. EEB192MK. The serviceman checked to make sure the unit was level and that the seals were clean. We even raised the front of the unit and unloaded all the items from the door shelves. Nothing worked.—Mrs. J.R. Clark, New Braunfels, Tex.

We suggest you check to see if your door gasket has hardened due to aging. Replace the gasket if there is any space between it and the door. If the gasket seems okay, use a

straightedge to check the door for vertical, horizontal or diagonal warpage. If it passes this test, home in on the hinges. It is important that there is a spacer (washer) between each hinge leaf and frame. Otherwise, you may pinch the gasket at this point and prevent proper closing. Also check that the hinges aren't twisted or damaged. If you check all this and still have the problem, replace the hinges.

Overflowing clothes washer

I have a Kenmore clothes washer, model No. 71960120. Occasionally, it runs over when refilling after the spin cycle. I've checked all electrical leads for proper contact and they are fine. Any suggestions?—Peter Dumas, Markville, Md.

You should also check the drain hose for a possible lint plug. If that's not it, your problem is probably in the float control switch. This is located near the top of the washer. It has a small plastic hose attached to it. Unplug the washer and remove one of the control wires and the plastic hose. Test the switch for continuity with a test lamp attached to the control switch terminals. If you use an ohmmeter instead of a test lamp, use the Rx1 scale. If the lamp lights, you have continuity. Blow gently into the hose while the switch is in the OFF position. If everything is working properly, you should hear a gentle clicking of the microswitch as your breath causes the sensor diaphragm to turn the switch on and off.

Down the tube

I have a Hotpoint side-by-side, no-frost refrigerator, model No. OSF-20EMR, that is 6 years old. My problem is excessive frost buildup in the bottom, which necessitates service calls every other month or so. I never had this problem until a serviceman replaced a defective defrost heater, but the succeeding technicians say the problem is dirt in the drip tube. What do you think?—Edward A. Whitman, Plainview, N.Y.

A clogged drip tube will certainly cause this problem. However, there

If you have a question about any appliance, send it, along with the model and serial numbers, to Appliance Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. Sorry, but letters cannot be answered individually. Problems of wide interest will be discussed in this column.

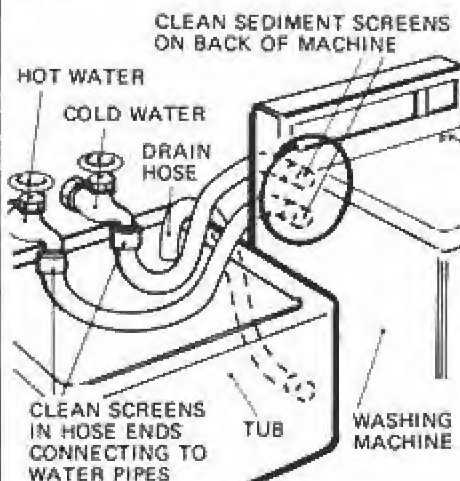
may be other problems involved. To start with some obvious ones: Are you sure the refrigerator door closes properly? If it doesn't, it could admit moisture-laden warm air to the box. Is the door opened and closed frequently? (Children are often culprits here.) Do you introduce excessive moisture by putting hot foods in the unit? Does the problem vary with annual humidity changes in the weather?

Check to see whether the door gasket has become hard with age. You might also have a defective defrost timer or defrost thermostat. The former is usually a "black box" with a dial in the bottom of the refrigerator. The thermostat is in the freezer compartment.

Check the circulator fan. Do this by turning the thermostat up all the way, then open the door and depress the switch button in the door frame. You should be able to hear the sound of the fan.

SERVICE TIP

■ If you find that the level of water delivered to your automatic clothes washer drops over a period of time, the problem is most likely caused by clogged hoses, which reduce water pressure to the machine. Most people think



Cleaning sediment screens at both hose ends helps maintain washer's water level.

they have dealt with the problem when they clean the lint and debris from the wire screens at the ends of the hoses where they connect to the faucets.

But most washing machines also have screens in the other ends of the hoses, where they attach to the machine. Reach under the machine, disconnect the hoses and clean the screens at those ends, too. Doing so once a year, or as needed, should restore pressure and raise the water level back to normal. **PM**

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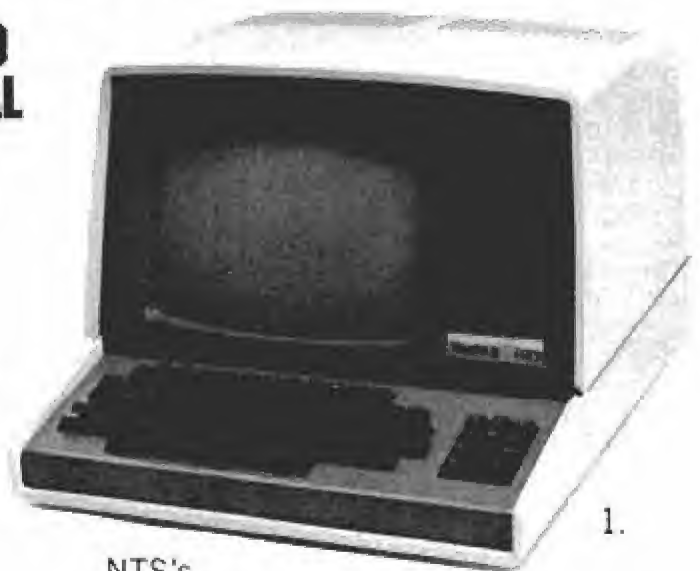
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The NTS/Rockwell AIM 65 Microcomputer (#2) is included in our Microprocessor Technology Course. It's a single board unit featuring an on-board 20 column alphanumeric printer with 20 character display. This 6502-based unit also has 4K RAM memory, expandable, 8K monitor ROM and 8K advanced BASIC interpreter on ROM.

And in NTS's Master Course in Electronics and Industrial Technology, you'll work with the NTS/KIM-1 Microcomputer (#3). This unit features a 6 digit LED display with an on-board 24 key hexadecimal calculator-type keyboard. It's a 6502-based microcomputer with 1K of RAM memory, expandable.



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PM ELECTRONICS MONITOR

RCA videodisc push

By the time you read this, RCA will have launched a national advertising kickoff of its new videodisc system. By now, you have likely been bombarded with TV and newspaper ads.

But if you are in the market for a videodisc, you're probably more confused than ever.

This seems an excellent time to recap a few pros—and cons—of the RCA system. RCA calls its disc a CED system (Capacitance Electronic Disc). There is quite a difference between this system and the Magnavox/Pioneer laser system.

RCA's videodiscs have grooves much like an audio record, but the grooves are amazingly narrow. In fact, the needle that "plays" the video is one-thirtieth the diameter of a diamond stereo needle. The competing laser system does not use a needle, but simply bounces a beam of light from reflective pits on the disc's surface.

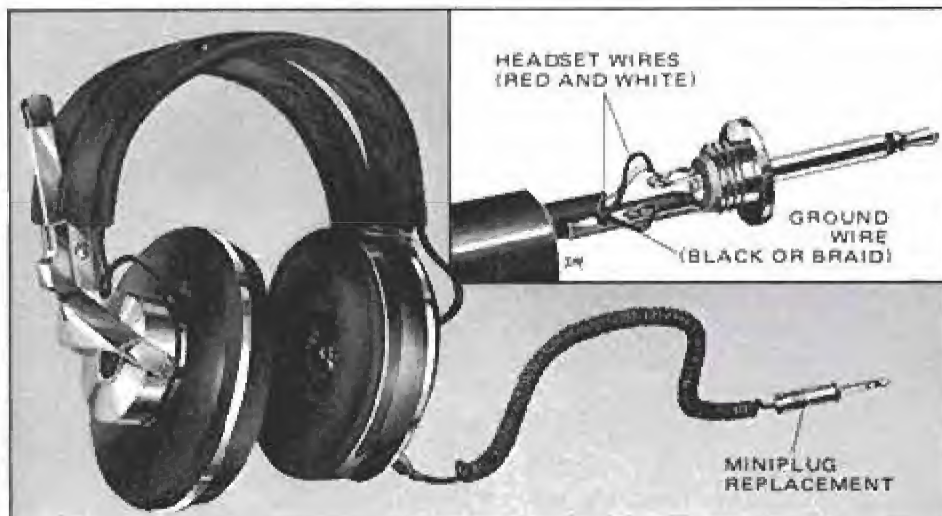
Picture quality is excellent on both systems. But the cost of the RCA player (announced in January as under \$500) is substantially below that of the laser player. Discs, too, are less expensive.

The only thing is: No one really knows how great the wear and tear will be on RCA's videodisc pickup stylus or on the discs themselves after continued at-home use. Unlike the laser system, there is bound to be some wear on both the needle and the grooves in which the needle rides.

Also, because a beam of light can be shifted without damage to the disc, the laser system has capabilities not offered by the RCA system. On the laser disc, you can search to a random frame, freeze a picture indefinitely and switch rapidly between faster- and slower-than-normal speeds.

And because the laser disc is a digitally encoded medium, it has the ability to offer digital stereo sound. (Right now, laser discs sound no better than normal stereo, but that will be improved.)

RCA maintains that testing on CED discs has shown no deterioration of either audio or video signals "after 100 plays." So, it would appear that the wear and tear problem has been licked—at least in the lab. But consumers should be aware that the CED disc, by nature, is more fragile than the laser disc and can offer fewer options.



Downsizing your headphones

You can get great sound from even a cheap pocket radio by using inexpensive stereo headphones that have been adapted to a miniature monaural plug.

Ready-made adapters are often difficult to locate and they can cost a few dollars. We used a 25-cent miniplug that you can buy at any

parts store—and it will take only five minutes to install.

Unsolder or cut off and restrip the wires of the existing 1/4-inch phone plug. There will be three leads—one for ground and one from each earpiece. Attach them to the miniplug as shown—then sit back and enjoy.

It will be most interesting to watch—and to continue to report on—the growing war between the forces of light and capacitance.

Computer Wizardry

It's been a long time since I've been amazed at what a computer can be programmed to do—but a new program from Siro-Tech (6 Main St., Ogdensburg, N.Y. 13669, \$34.95) does amaze me. It pushes the Apple II computer to its limits.

Similar to some of the computer adventure games we reported on in our Oct. '80 issue (*New Computer Adventure Games*, page 22), the game *Wizardry* involves assembling a party of adventurers to explore an imaginary and dangerous land. But the amount of detail is fantastic.

You begin by organizing a party of explorers and having them trained. Men, dwarfs, mages and berserkers—all have their own different and interacting game values. Objects, money, weapons and armor may all be traded back and forth among the various adventurers, who may be controlled by one or more people at the computer keyboard.

The dungeon itself is displayed in realistic three-dimensional graphics on the screen as the assembled party moves through the dark passages. Attacked by various dangers, the adventurers can act as a group or individually.

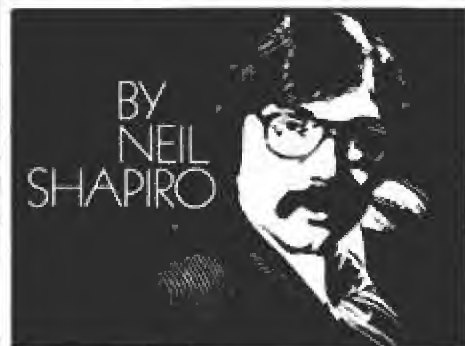
The game's designers, Robert Woodhead and Andrew Greenberg, tell us that the program (the instructions the computer must store) is 25,000 lines long. The information to generate the dungeon requires 80,000 bits of computer memory.

For some reason, games have always been the herald of new developments in personal computer programming. This new game may open up a whole new realm of programming.

Stop tool zaps

Etcon's new TT-120 tool tester makes certain that your power tools are well grounded. A tool, such as a drill, is simply plugged in. If a green LED comes on, all is well—a red LED indicates an unsafe plug or an internal short. Available from large electrical supply stores, the tester seems to be a good idea. Better to be safe than zapped.

PM



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LETTERS TO THE EDITOR

Another Howard Hughes mystery

I must congratulate you on your research in bringing out the many details of the airplane in which Howard Hughes crashed (*The "Mystery Plane" That Almost Killed Howard Hughes*, page 90, Jan. '81).

Perhaps I can clear up another mystery regarding what happened the day Hughes and I were making a taxi run. We were both absorbed by the instruments, not realizing how fast we were going and how quickly the two-mile field was being eaten up. When we looked up, the trees were rushing toward us. Hughes slammed on the brakes and, I believe, burned them out. I quickly reached over his shoulder and flipped the reverse switches for the propellers. They went into full reverse and stopped us before we crashed.

Hughes took one look at me, said nothing and walked off the field, as you reported. I was not aware until reading your article that he never commented on why the propellers went into reverse. Had they not worked properly, I would not be writing this letter today.

FRANK J. PRINZ
SOUTH LEE, MASS.

A fascinating insight into the Hughes manner. The only known comment made at the time was that the props reversed "for no apparent reason." This is very possibly because Hughes would have been reluctant to mention Prinz's version of the incident—even to his own people.

Standard model—optional wheels

I wish to differ with your identification of the "Whatsit" in the Jan. '81 issue (*PM Briefs*, page 25). Rather than being "cobbled up from an old, narrow-gauge steam locomotive," it is a Lombard Log Hauler, made in the early 1900s by the Alvin O. Lombard Traction Co., Waterville, Me.

These machines were specifically designed to haul logs out of the Maine woods on trains of up to 12 sleds over ice-covered winter roads. In designing the hauler, Lombard invented and patented the crawler track that came to be used on bulldozers and military tanks.

DON GARLOW
SACRAMENTO, CALIF.

There was absolutely nothing "cobbled up" about the famous Lom-

bard Log Hauler. They all had sled runners up front for steering. The wheels shown in your "Whatsit" were merely added to permit the display of one old runnerless relic at a show in Owls Head, Me.

C. F. STODDARD JR.
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PM Mini Barn becomes garage

Thought you might like to see a photo of your Dutch Mini Barn converted to a home for my son's MG. We added four feet to the length and widened the door opening a few inches.

The barn not only makes an attrac-



PM's versatile Dutch Mini Barn (top), as enlarged by cover artist Ed Valigursky to shelter an MG sports car. Sketch (above) is Ed's fanciful notion of how the Mini Barn might look if it were put on wheels.

tive garage, but there's an added bonus: loads of storage space.

ED VALIGURSKY
WYCKOFF, N.J.

As many readers will instantly recognize, Ed Valigursky is our talented cover artist whose dramatic action paintings appear regularly in PM. Ed is also adept at cartoon humor, as his whimsical sketch (see above)

(Please turn to page 42)

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LETTERS TO THE EDITOR

(Continued from page 40)

attests. Plans for building the Dutch Mini Barn are \$3.95 for one set or \$5.95 for two sets, plus 75 cents for postage and handling (extra set is for obtaining a building permit). Send order to Popular Mechanics, Box 1014, Radio City Station, New York, N.Y. 10101.

The glorious Chevy V8

Rich Taylor's article *The Rise and Fall of the V8 Engine* (page 95, Dec. '80) was one of the most interesting and informative short stories on the evolution of the V8 engine that I've ever had the pleasure of reading.

Mr. Taylor's depiction of the small-block Chevy V8 as "the engine of the last three decades" was both an accurate and superb choice. The racing world's record books certainly bear this out. Many an exotic and expensive racing engine coughed up its innards trying to keep up with the Chevy V8.

I believe, however, that Mr. Taylor may have erred a bit in failing to mention Zora Arkus-Duntov, of Corvette fame, as one of the original designers responsible for developing the small Chevy V8.

HOWARD HAWKS
DETROIT

Rich Taylor replies: Zora Arkus-Duntov was responsible for the racing versions of the small-block Chevy. The original design of the engine is credited to Harry Barr, Ed Cole and John Dolza. They had completed the small-block project and ordered the machine tools for it in June 1952. Duntov didn't go to GM until May 1953. Before that, he was with Fairchild Aviation.

Another source of clocks

In our February article *A Lincoln Legacy: Two Mantel Clocks You Can Build* (page 130), we omitted one source of quartz movements, dials and accessories: Klockit, Box 629, Lake Geneva, Wis. 53147. Readers can write for a free catalog.

Half right but still wrong

In the Dec. '80 *PM Electronics Monitor* (page 8), we told readers how to spot a possibly faulty telephone transformer.

Unfortunately, the text did not agree with what the artwork showed. The correct advice to follow is contained in the label on the art: "If cutout matches your transformer, your unit is okay." If it doesn't match, call your phone company for a service check.

PM

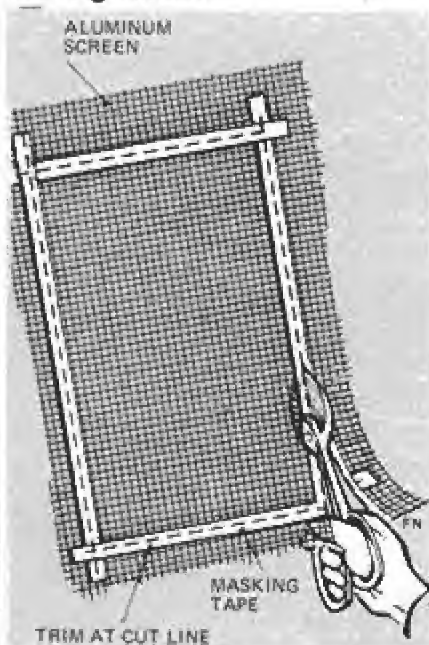
HINTS FROM READERS

Sharp carpenter's stunt



The broad point on a carpenter's pencil wears out quickly because of the rough wood it is used on. Many professional carpenters keep a sharp point by stroking the pencil against a small patch of 100-grit sandpaper attached to a saw handle with double-faced tape. —Ken Patterson

Cutting screen



A simple but effective way to mark aluminum screen clearly for cutting is first to outline the rough measurements with masking tape. Then mark the cut lines precisely on the tape. Finally, cut the aluminum screen with tin snips. —Charles B. Crow

Putting zip in zippers

Use soap to lubricate zippers that are difficult to operate. For a more effective lubricant, use graphite scraped from a lead pencil. —Robert Slade

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CAR CLINIC

SOLUTIONS FOR MECHANICAL HEADACHES BY MORT SCHULTZ



The price of inflation

I recently purchased four Goodyear Arriva P165-80R15 tires for my 1974 Volkswagen Super Beetle. The Goodyear dealer inflated each tire to 32 pounds. When I brought to his attention the fact that VW recommended pressures are 18 pounds in front tires and 26 pounds in rear tires, he said I shouldn't go by this—that running less than 32 pounds in metrics would ruin the tires. My VW service manager says the opposite. The metric size notwithstanding, he says if I don't follow VW's recommendation, tires will wear prematurely and the car won't handle as it should, especially on wet roads. Who's right?—Mirek Jalowiec, Oak Ridge, N.J.

Your service manager is more right than the tire dealer. According to engineers at Goodyear Tire and Rubber Co. and Volkswagen of America, you can safely inflate the Arriva tires on the front of the VW to 21 pounds and those on the rear to 29 pounds. The additional three pounds may get you a little better gas mileage, without affecting the car's handling. However, pressure in excess of three pounds, especially in front tires, is asking for trouble. Inflating front tires to 32 pounds will result in worn-out center tread within a few thousand miles.

Gas attack

According to my dealer, the automatic intake fan in my 1980 Chevy Malibu station wagon can't be turned off. I have asthma, and the fume intake is making life unbearable when I drive through a city. Please help.—Mrs. A.R. Evers, Fayetteville, N.Y.

If you have a manually operated air conditioner with a MAX selector, tell your dealer to find the control valve for the automatic intake. It's behind the glove compartment and has an orange hose connected to it. Disconnect and plug this hose, and run a vacuum hose from an engine vacuum source to the valve. This will cut intake ventilation about 80 percent. If you want to reduce it to zero, have the dealer install a cover

plate over the fresh-air intake beneath the cowl.

Maybe a mouse?

The clutch return spring in my 1980 Jeep CJ-7 squeaks like mad. "A characteristic of this vehicle," the Jeep service manager says. He's sprayed it with various compounds and now contends that nothing can be done. The squeak is annoying. Do I have to live with it?—Norman Beach, Nantucket, Mass.

It's hard to believe that the spring is squeaking, because it doesn't rub against anything except at both ends where it engages levers. So spraying isn't going to help, unless the squeak is coming from one of the ends. I'm more inclined to believe the squeak is caused by the clutch pedal pivot. If I'm right, disassembling the component and lubricating each rubbing point with general-purpose or wheel-bearing grease should stop the noise. Just to be safe, also remove the return spring and coat its ends with grease.

Give a Vette a brake

I'm in the process of replacing my fourth brake caliper on a 1975 Cor-

vette. Each one started leaking when severe corrosion built up in the caliper bore. This problem is characteristic of the Vette disc-brake system, as any owner can tell you. When it happens, the caliper has to be replaced with a new one.

Recently, I've heard of a company called Vette Brakes Inc., that rebuilds Corvette brake calipers so they'll never corrode again. You'd be doing Corvette owners a favor by finding out more about this company.—Peter Zajkowski, Poughkeepsie, N.Y.

According to the owner of Vette Brakes, John Thompson, he started the company about four years ago, because as a Corvette owner himself he recognizes a vacuum that needs to be filled. As you mention, Peter, the caliper to support the four pistons of the Corvette disc brake has been a sore point for a long time. Its average life is about five years. When it corrodes, there's been no alternative until now but replacement. Caliper bores which become pitted can't simply be reamed out. Doing so would result in removing too much metal. Vette Brakes solves this by inserting sleeves in the bores.

Corrosion is a result of brake fluid absorbing moisture. This leads to a restructuring of brake fluid chemistry and alters its pH to less than 7. Brake fluid turns acid and reacts on the aluminum pistons and iron calipers. This galvanic action produces pitting.

Thompson's outfit cleans the caliper inside and out, and fits bores with stainless-steel sleeves that provide a fit exceeding the factory specifications of new calipers. The stainless-steel sleeves are guaranteed

(Please turn to page 48)

UTQGS

Once you get acquainted with it, the new Uniform Tire Quality Grading System of the U.S. Department of Transportation can help you get the best set of tires for the least money. In fact, the National Highway Traffic Safety Administration contends that some tires as much as \$30 lower than others offer the same performance.

A complete list of tires and their ratings is available through credit unions, recreation associations, consumer information offices and other consumer-oriented groups. Each new tire has a label giving its ratings. These are also molded in the sidewall.

Tires are graded for the following:

- **Tread wear.** This shows mileage you can expect from one tire compared to another. For instance, a tire rated 150 will have about 50 percent greater tread wear than one rated 100.
- **Traction.** This indicates the ability of a tire to stop on wet pavement. Tires rated A will stop on wet pavement in a shorter distance than those rated B. C is the lowest rating.
- **Temperature resistance.** This judges the resistance of tires to high temperature produced while rolling. Tires rated A will run cooler than those rated B; cooler yet than those rated C.





Rockwell 1/2" Single Speed Drill Model No. 4201 Powerful 2.8 amp motor develops 25 h.p. Drills through 3/2" in metal, 1" in wood. Built with double reduction gears, precision ball thrust bearings. Comes with side handle, chuck key, 6' cord. U.L. listed.

Rockwell 10" Homecraft Motorized Table Saw Model 34-695: With 22" x 32" rugged cast aluminum table. Rips 24" enough for 4' x 8' panel. Cuts 3 1/4" deep at 90°; 2 1/4" at 45°. With self-contained high torque power unit, see-through blade guard with splitter, anti-lockback attachment, self-aligning rip fence. U.L. listed.

BUY THIS SAW FOR LESS THAN \$375. GET THE DRILL FOR 1¢ MORE.

Ask yourself: when was the last time you got anything for 1¢?

Right now, 1¢ buys a lot in the Rockwell 1¢ Sale. Because when you get our 10" Homecraft Table Saw — the big capacity saw that delivers precise, accurate cuts every time you turn it on — you also get our tough 1/2" Single Speed Drill for just 1¢ more. And these days, that's money well spent.

So visit your Rockwell dealer during the Rockwell 1¢ Sale. And remember to bring an extra penny.



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THE ROCKWELL 1¢ SALE.

Special Clarion offer on in-dash AM/FM stereo cassettes

Three good reasons to invest in quality now!

Buy any of the twelve Clarion in-dash AM/FM stereo cassette combinations before May 16 and get Clarion quality backed with a **FREE THREE-YEAR WARRANTY** and a **FREE ALLSOP 3 CASSETTE DECK CLEANER**.



1. Clarion Quality
All Clarion stereo cassette combinations are precision engineered to fit shrinking in-dash spaces and incorporate advanced audio technology to bring high fidelity sound alive in your car.

The Clarion line goes from simple self-contained units to high-powered, ultra-sophisticated models with electronic scanning or computerized, fully programmable capabilities.

Many models feature Clarion's Magi-Tune™ FM with improved Signal Actuated Stereo Control (SASC) that locks into stations even in the worst reception areas.

The options are yours...Dolby® noise reduction, separate bass and treble controls, loudness control, auto reverse, tape equalization, sendust alloy heads...you name it, Clarion's got it.

Clarion systems are priced to fit every pocket, from less than \$100 to over \$1,000.

*For the name of your nearest Clarion dealer call toll free (800) 421-2119; in California (800) 272-1721. 800 numbers will be discontinued after May 16, 1981.

2. Free Three-year Warranty

Clarion backs up its product reliability by picking up the tab for the Clarion warranty extender on tape/radio combinations (parts and labor) for a total of three years. You save \$7.50 on the extender, but the real value is Clarion's commitment to your trouble-free listening pleasure.



3. Free Allsop 3 Cassette Deck Cleaner
We'll pay you to take good care of your Clarion with the Allsop 3 Cassette Deck Cleaner. Its patented action gently and effectively cleans the head, capstan and pinch roller simultaneously. Allsop 3 also eliminates dust, dirt and oxide buildup on the pinch roller, reducing "tape eating" and slippage.



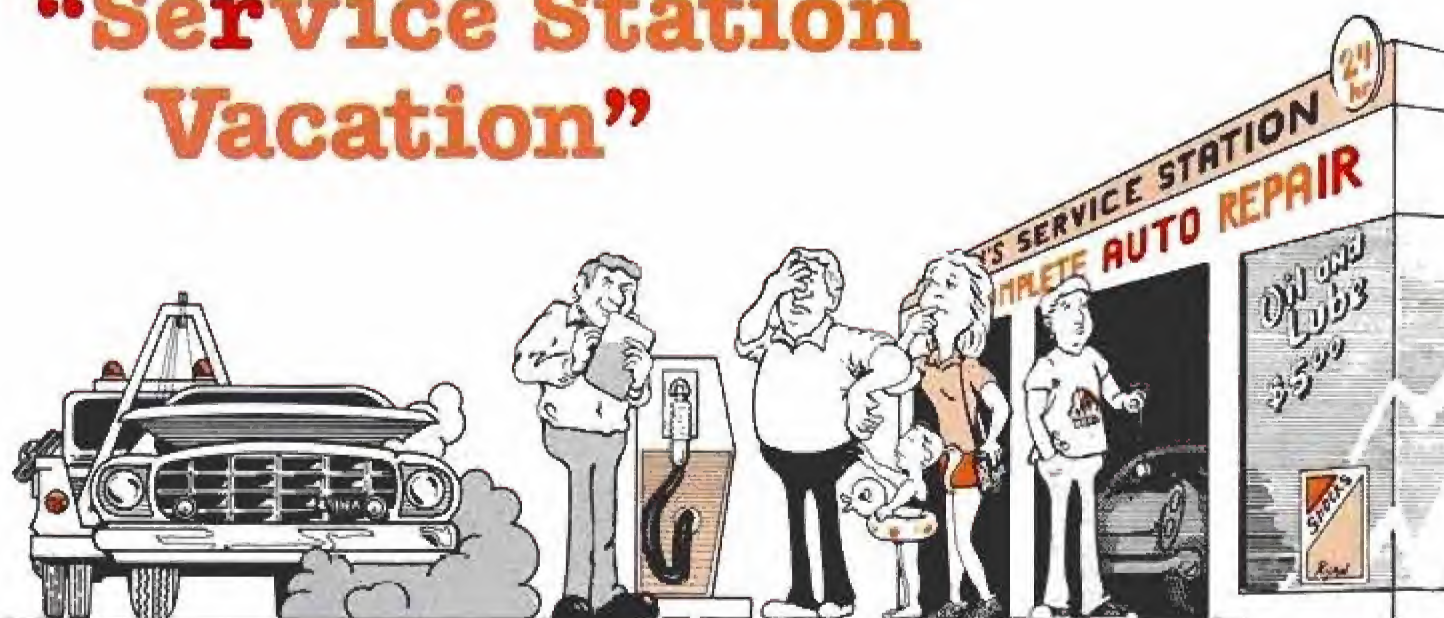
You save another \$6.95 and gain added insurance for your cassettes while you maintain your Clarion's optimum performance.

Hurry—Offer limited!

This special offer will be available at participating Clarion dealers* for only 60 days...from March 16 through May 16 (inclusive). Save money and protect your investment by taking us up on our offer now!

 **Clarion**
It's a great deal

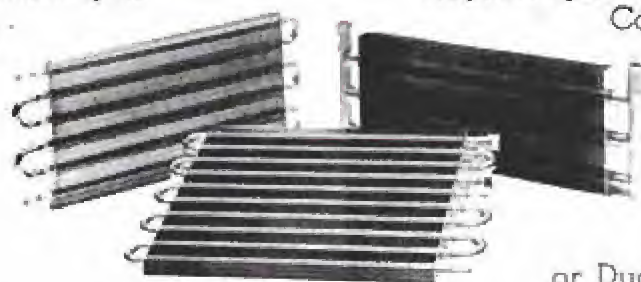
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Insure against overheating — don't leave home without the low cost protection of a Hayden Transmission and Engine Oil Cooler.

Heat — Your Car's Greatest Enemy.

Today's down sized cars run hotter due to emission controls, smaller engines and higher RPMs. Heat problems develop when you carry extra passengers . . . extra baggage . . . drive in stop-and-go traffic . . . drive on ice or snow . . . drive in hot temperatures . . . climb steep grades . . . and do towing.



**Over 11 Million
Transmissions failed last year*.**
9 out of 10 were caused by overheating.

Low Cost Protection.

You wouldn't think of owning a home without insurance and yet the risk of burning up your car's transmission and engine is greater. Repairs can run as high as \$600-\$1500. You can buy transmission and engine insurance by installing a Hayden Oil Cooler for as little as \$29.95.

*Courtesy ATRA

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If you can change the oil in your car, you can make the installation yourself in a half hour using Hayden's patented Quik-Mount and Quick Connect. Complete illustrated installation instructions come packaged with every oil cooler.

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**Offer expires December 31, 1981. CA residents add 6% sales tax.

For free product brochure, write:



HAYDEN INC.

1531 Pomona Road, Corona, CA 91720

CAR CLINIC

(Continued from page 44)

never to leak or fall out, as long as the car is with the original owner.

The price for repairing and returning to the owner a fully assembled caliper is \$83 per wheel for Corvettes and Camaros. There is more cost involved, since customers pay the freight both ways.

Vette Brakes also repairs 2 1/8-in. calipers for 1967 and 1968 GM cars. New calipers for these cars are virtually nonexistent. The price for repairing them is \$135 per wheel.

Before shipping off your calipers, Thompson suggests you get in touch with him for more information. You can write Vette Brakes Inc., 3150 23rd Ave. N., St. Petersburg, Fla. 33713. If you wish, call (813) 321-3722.

Enough already

Twice before I wrote about front-end noise from 1980 GM X-body cars when making full right and left turns. Now I've learned that GM has issued new lower-control-arm steering stops. The original stops made crunching-type noises when the steering knuckles rubbed against them. The part numbers for the new

steering stops are LH14026941 (left-hand stops) and RH14026942 (right-hand stops).

You can write me about any noise in any car. But please—no more about this one.

Hamstrung

I own a 1979 Oldsmobile Cutlass Cruiser with the 5.7-liter diesel engine. At 18,500 miles, the dealer replaced head gaskets when I found combustion products in the coolant. The work was done under warranty. Now, only 500 miles later, I'm noticing a considerable amount of blowby. When I remove the crankcase fill cap, it drips oil and, if the engine is running, a considerable amount of oil vapor is present. The engine is using only 1 1/4 to 2 quarts between oil changes. The dealer says it's normal for the diesel and that my other problem has nothing to do with this. Can I believe the dealer?—Sid Schain, Salem, Ore.

According to Oldsmobile, you can. But, I guess, only time will tell. Olds engineering in Lansing, Mich., told me that the conditions you describe are normal for this engine. Oil is coming up the fill tube because of turbulence in the crankcase. Engineering also says that if there was

Built-in wash basin



There's nothing new about carrying tools and equipment in a car in anticipation of an on-the-road emergency. But after overcoming the problem, you usually find yourself with another "emergency." How do you get your hands clean?

R.A. Martinson of St. Cloud, Minn., has this answer:

"Rinse out an empty plastic hair shampoo bottle or tube and fill it with a waterless hand cleaner from a pump-type dispenser. Screw the cap on the hair shampoo bottle, wrap it in a rag or paper towel, secure it with a rubber band and place it in your tool kit. No more dirty hands after a roadside repair—and it's compact, unbreakable, leakproof and economical."

Also first rate. Thanks, Mr. Martinson.

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warns of weak battery, malfunctioning alternator, fan belt problem, faulty regulator



VDO OIL PRESSURE

GAUGE pinpoints defective oil pump, blocked or faulty suction pipe, sticky or leaking oil pressure relief valve



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alerts you to the rising temperatures that can reduce lubrication and damage the engine



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AN EARLY WARNING SYSTEM FOR YOUR CAR

Before your car breaks down... before the damage is done, VDO gauges will warn you. They provide the fastest possible readout on developing problems in your car's engine or electrical system.

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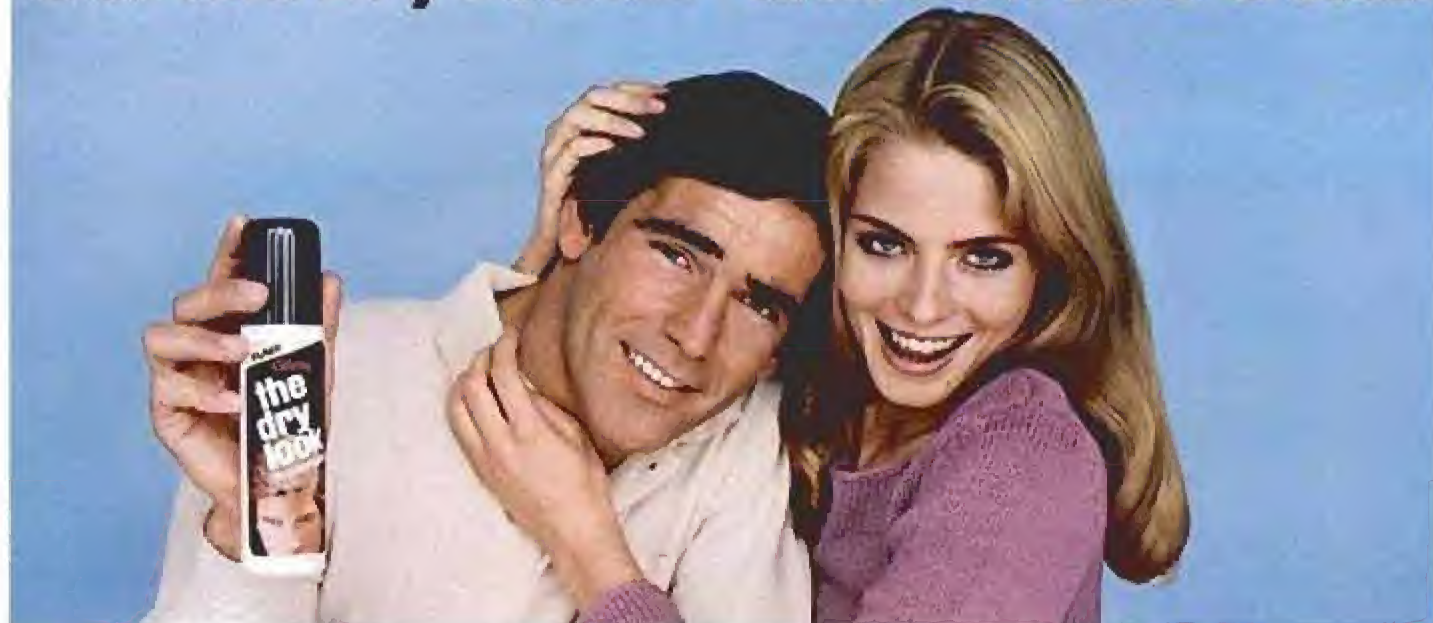
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Get the hold that leaves hair feeling as soft and natural as it looks.

The Dry Look® gives you more than a great look. It leaves your hair feeling soft and natural, too — not too stiff. The Dry Look in pump spray or aerosol — with a formula that's right for your hair. Get The Dry Look...and don't be a stiff!

© The Gillette Company, 1981



Available in pump or aerosol.

an excessive pressure buildup, oil would leak past seals, and you would be using a lot more than 1½ to 2 quarts between oil changes. You'll have to go along with Olds on this, because there's nothing else you can do. But, at least you're on record should anything happen.

Hold your nose

If true, the practice by some GM dealers of trying to sell diesel fuel antimoisture electronic systems to owners of cars with gasoline engines makes the Fulton Fish Market smell like lilacs in bloom. The system developed by GM's AC Spark Plug Div. helps combat the moisture buildup problem in cars with diesel engines. Excessive water can ruin fuel-injection pumps (see *Car Clinic*, page 50, Jan. '81). I've gotten wind that some dealers are telling customers the AC system will do a bang-up job of preventing water in a gasoline tank. Don't fall for it. You can buy a lot of cans of gasoline-system additive (so-called dry gas), if it's needed, for the \$50 plus labor charge the diesel system costs.

Plugging along

Following capacity instructions to the letter, I've replaced oil in my 1979

Ford 302-cu.-in. engine on two different occasions. In both instances, the dipstick has shown an overfull condition.

There is nothing wrong with the dipstick. I matched it against one from another 302 engine. What else can be wrong?—Thomas O'Neal, Louisville

Did you remove both drain plugs from the oil pan? In addition to the one in the usual location under the front of the pan, there's also one at the rear on the left side. Both plugs must be removed to thoroughly drain the pan. Otherwise an over-filled crankcase results when new oil is added. In addition to the 302-cu.-in. (5.0-liter) engine, the 1979 255-cu.-in. (4.2-liter) and 1979 351W-cu.-in. (5.8-liter) engines have two drain plugs.

The same engines in 1980 and 1981 models also have two drain plugs. However, the rear drain plug is on the bottom of the pan—and not on the side.

GOT A PROBLEM WITH YOUR CAR?

Just ask Mort about it. Send your question to the Car Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. While letters cannot be answered individually, problems that are of general interest will be published in the column.

SERVICE TIPS

■ General Motors warns that gasoline splashed on a paint finish can cause loss of gloss or severe staining. If this happens to your car and you can't bring back the finish with a compound, sand the affected area with No. 400-grit wet or dry sandpaper until the dull paint or stain has been removed. Then repaint the area.

■ Mercedes-Benz has recalled about 17,000 1976 models equipped with V8 engines. Involved are the 450SE, 450SEL, 450SL and 450SLC. The problem is a plastic automatic transmission bellcrank bushing that may become deformed because of heat, and thus prevent the throttle linkage from returning to its idle position.

Having the plastic bushing replaced with a metal bushing is a free job for you.

■ Ford Motor Co. 1978 Pintos, Bobcats, Fairmonts and Zephyrs built between Jan. 1 and 31, 1978 and which are ping-pong and performing improperly may have crankshaft pulleys with incorrectly stamped timing marks. To find out, remove the access plug from the cam drive-belt cover and look through the access hole in the belt cover. Set the crankshaft to top dead center (TDC) by aligning the timing pointer on the inner belt cover with the timing mark on the camshaft sprocket. Now, check the crankshaft pulley. If the timing mark isn't indicating 0° ± 1°, replace the pulley. The parts department of a car dealer can tell you which pulley is right for you.

PM



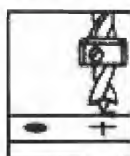
Price Breakthrough On The WOODBITS The PROS Use!

American woodworkers have been so won over by our German woodbits that we now order large enough quantities to enable our German factories to have permanent production lines for our sizes. As a result, prices have dropped sharply, as you can see below.

Why is a WOODBIT Best?

A PROFESSIONAL WOODBIT has four features designed specifically for wood:

- A CENTER SPUR that locks your bit on course and so prevents "skating".
- TWO CUTTING SPURS that start and dimension a perfectly round hole.
- EXTREMELY SHARP FLUTES extend from the two cutting spurs and continue the cutting action all the way through the wood... shaving the sides smooth. Most important, the two spurs will not splinter the wood as the bit cuts through... as spade or metal cutting bits do.
- THE CUTTING FLUTES ARE ENGINEERED for optimum chip ejection so that your drilling machine won't bind and burn out.



LEICHTUNG'S PROFESSIONAL WOODBITS can be used in portable drills or drill presses with chucks of $\frac{3}{8}$ " or more. 7 piece chrome-vanadium steel set includes $\frac{1}{8}$ ", $\frac{3}{16}$ ", $\frac{1}{4}$ ", $\frac{5}{16}$ ", $\frac{3}{8}$ ", $\frac{7}{16}$ " and $\frac{1}{2}$ " sizes. Lengths from $2\frac{3}{4}$ " - $5\frac{3}{4}$ ". Made by German professionals for pros or "wood-be" pros.

7 PIECE WOODBIT SET ~~\$17.95~~ **ONLY \$11.95**

Depth Adjusting Collars For The 7 Piece Set



Get the precision of a costly drill press for under \$10.00! Here's how they work: Figure the desired depth of the hole; slip the collar over the bit to that depth; fix the collar position with the set screw — and drill. 7 collar sizes, $\frac{1}{8}$ " - $\frac{1}{2}$ ". fit each bit in the 7 piece woodbit set. Tool steel.

7 Piece Depth Adjusting Collars ~~\$9.95~~ **ONLY \$6.95**

Buy Both Bits And Collars And SAVE \$2.00..... ~~\$25.90~~ **ONLY \$16.90**

Complete Your Bit Set With These 4 BIG WOODBITS

Primarily for use in a drill press, these larger diameter bits can be used in any powerful portable drill with a $\frac{3}{8}$ " or larger chuck. These are really top quality professional cutting tools. The $\frac{3}{4}$ " bit is $7\frac{1}{8}$ " long, the $\frac{1}{2}$ " and 1" are $7\frac{1}{2}$ " long. No collars available.

$\frac{3}{4}$ " Bit... ~~\$14.95~~ **\$9.95**
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 $\frac{3}{8}$ " Bit... ~~\$10.95~~ **\$13.95**
 1" Bit... ~~\$17.95~~ **\$15.95**

Buy All 4 BIG Woodbits ~~\$49.80~~ (SAVE \$17.95) **ONLY \$39.95**

COMPLETE 18 Piece Drill Set ~~\$69.95~~ **ONLY \$54.95**

18 PIECE SET INCLUDES:

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Only \$7.95

World Famous Pilot's Glasses
 These precision flight glasses are now available to the public for only \$7.95. If you could buy them elsewhere, they'd probably cost you over \$20.00. #20P available in gold or silver frame. A \$20.00 value only \$7.95. Two pairs for \$14.00.



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FREE case with each pair.

Save 35% at Sears



The SteadyRider Shock. Sears Best radial tuned shock. Designed for use with either radial or bias-ply tires. Helps deliver great handling and a great ride. Now just \$10.99 each. Installation extra. Sale starts March 29th.

Deadline May 2nd

You can count on

Sears

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This is the minimum savings nationally. Regular price varies in some markets. Prices and dates may vary in Alaska and Hawaii.

Save 40% at Sears



SuperGuard Belted Tires at our largest savings ever. Two fiber glass belts. Good traction. Long wear. Now 40% off. As low as \$29.75 for size A 78-13 Whitewall. Plus \$1.69 Federal Excise Tax. Sale starts March 29th. While quantities last.

While they last

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ONLY FORD DOES IT! 21 MPG* WITH 2,530-LB. PAYLOAD.



Ford, America's best-selling pickup for four straight years, leads again in '81. It's the first and only pickup that can deliver 21 estimated MPG and over 2,500 lbs. of payload. And Ford's husky 300 Six also delivers more engine torque than competitive Sixes. Why settle for less? Pick a pickup designed for the needs of the 80's—the tough, efficient '81 Ford.

29

EST.
HWY.

21

EPA
EST.
MPG*

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First Ford 21 MPG Six*
Only the tough '81 Ford has an estimated MPG this high with payloads as big as 2,530 lbs.

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Based on 1980 calendar year retail deliveries.

1102

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MILES*

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LWB Styleside with optional tank

First in driving range*
Only Ford has this estimated range. Standard and optional 19-gal. tanks total 38 gallons.

First truck V-8 Automatic Overdrive option

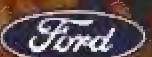
Only from Ford! New automatic transmission shifts into overdrive at about 45 mph... automatically. Available with 5.0L V-8.



First design for the 80's
Totally redesigned last year, Ford pickups are roomy and inviting inside... trim and aerodynamic outside for extra efficiency.

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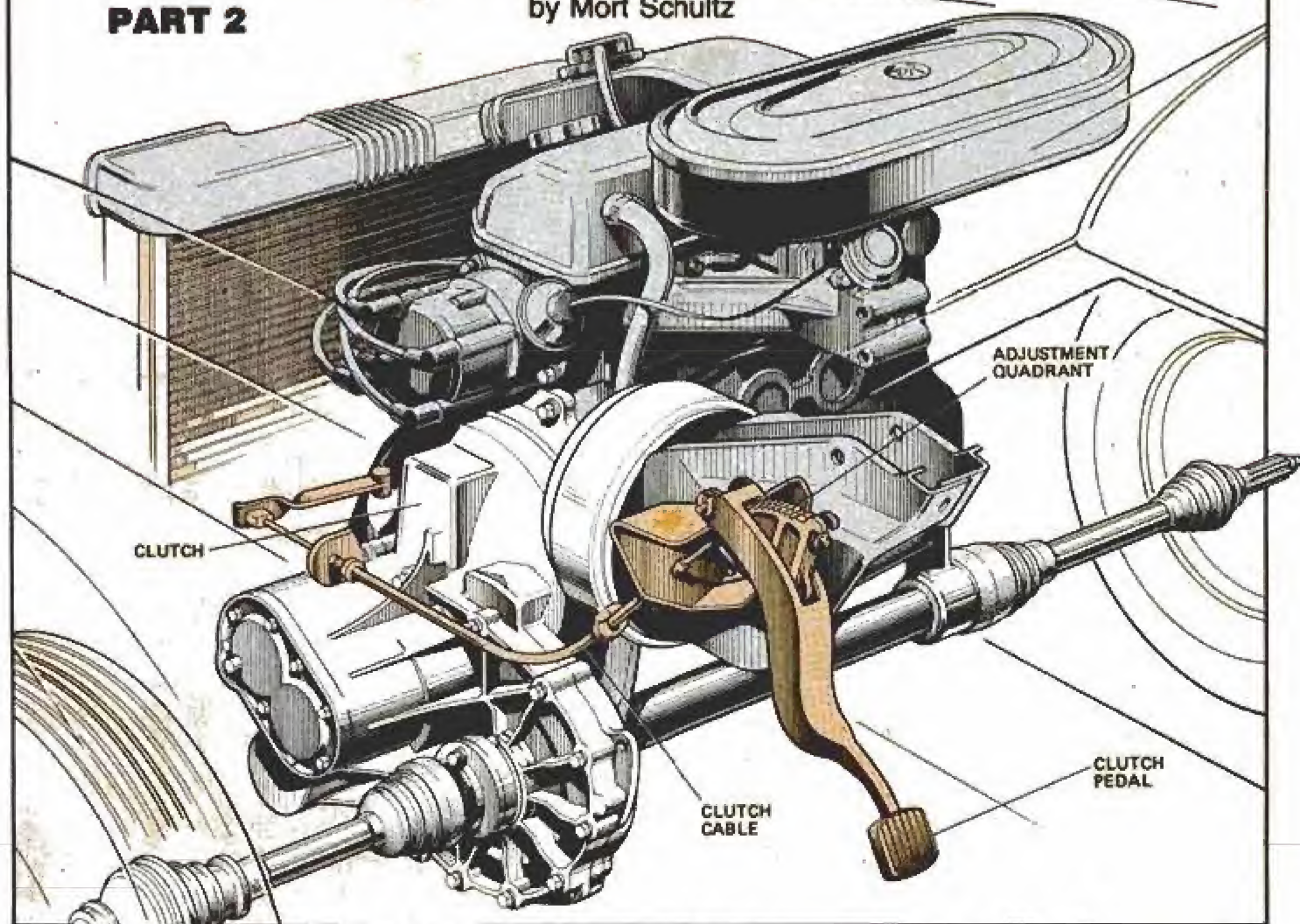
FORD DIVISION



SERVICING DETROIT'S FRONT-WHEEL-DRIVE GENERATION: THE X-CARS, K-CARS AND ESCORT/LYNX

PART 2

by Mort Schultz



The Escort has a self-adjusting clutch system. As you depress the clutch pedal, a pawl engages the quadrant and pulls on the cable to compensate for clutch wear.

TRANSAXLE SERVICE

Model	Service and Frequency
K-car*	Check differential fluid level of an automatic transaxle every 12 months or 7,500 miles. Check fluid level of a manual transaxle every 12 months or 7,500 miles.
E/L	Check automatic transaxle throttle-valve linkage for correct adjustment at first 10,000 miles, then at 30,000 miles and every 30,000 miles thereafter.
X-body	Lubricate manual or automatic transaxle shift linkage every 12 months or 7,500 miles. Inspect drive axle boots every 30,000 miles.

*Car marked with asterisk in charts is especially easy to service.

Ford Motor Co. says that doing scheduled maintenance on the 1981 Escort and Lynx (E/L) should require "no more than one hour" a year. Chrysler Corp., more conservative, claims that servicing the 1981 K-car will take four hours a year. GM doesn't stipulate a time for servicing the 1981 X-body, but from our experience it will take a little longer per year than working on the K-car.

You might think it hardly seems worth the effort, and you may forget to do scheduled maintenance altogether. Therein lies the danger of these new minimum-maintenance cars. Lack of scheduled maintenance—however little it may be—leads to mechanical problems which point, in turn, to major repairs costing much more time and money than the 2½ to four hours and the



DRIVE AXLE BOOTS

\$35 to \$45 anticipated per year for scheduled maintenance by Chrysler, Ford and GM.

In last month's Saturday Mechanic, we started outlining and comparing the scheduled maintenance services of the E/L, K-car and X-body. Additional services are discussed herewith. Where a particular model, in our judgment, stands out in design to simplify scheduled maintenance, we give it a star (*).

Transaxle service

The differential plug in a K-car has a unique design. A hex-shaped outer perimeter lets you remove it with an open-end wrench. This plug, which has a recessed center, may also be removed with a 1/4-inch socket.

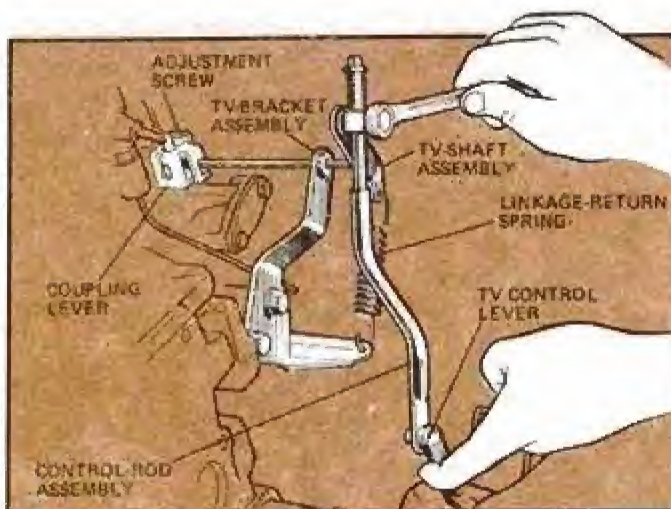
If your K-car has an automatic transaxle, see that the differential fluid level is within 3/4 inch of the bottom of the fill-plug hole. Make a measuring tool by bending a piece of welding rod 90° 3/4 inch from one end. Insert the bent end into the differential and withdraw it. If fluid is needed, add Dexron II Automatic Transmission Fluid.

Check K-car manual transaxle fluid level the same way. If needed, replenish fluid with Dexron II.

Neither the differential fluid of a K-car automatic transaxle nor fluid in a K-car manual transaxle need ever be changed unless lubricant is contaminated with water. Don't worry unless you drive where water reaches the transaxle.

For smooth shifting, the Escort/Lynx has an automatic transaxle throttle valve (TV) linkage that needs readjusting whenever the carburetor idle speed is reset (see below). According to the maintenance schedule, the idle speed should be checked at 10,000 miles (or 10 months), at 30,000 miles (or 30 months) and every 30,000 miles thereafter. Whenever you reset the idle to meet specification, readjust the TV linkage.

The linkage extends from the car-



buretor to the transaxle. Adjust it from inside the engine compartment, as follows, after warming up the engine and adjusting idle speed:

1. Turn off the engine. Make sure the carburetor throttle lever rests against the curb-idle stop (antidieseling solenoid). If not, the engine isn't warm enough.

2. Set the coupling lever adjusting bolt at midpoint. Be sure the TV linkage shaft assembly is seated fully in the coupling lever, but be careful. You are near the EGR—hot enough to burn you if you touch it.

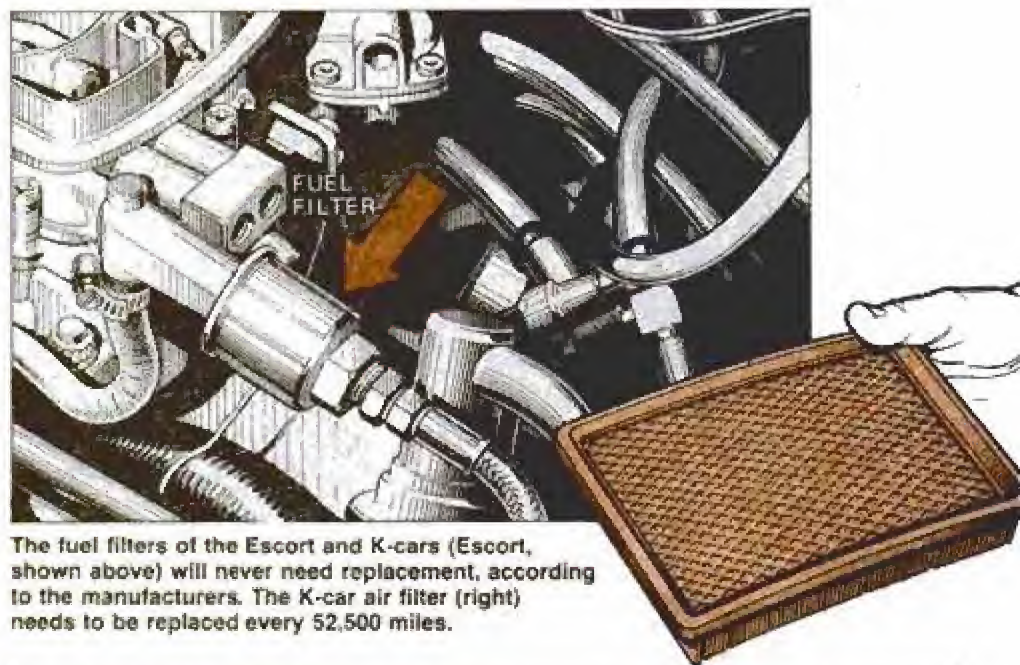
3. Loosen the bolt on the sliding

trunnion block (on the TV-linkage control rod) at least one full turn. The trunnion is now free to slide up and down.

4. With one finger and light pressure, rotate the TV control lever upward until it won't go farther. Don't force it. The lever is now against the idle neutral stop in the transaxle.

5. With light one-finger pressure on the lever, tighten bolt on the trunnion block securely.

6. See that the carburetor throttle lever still rests against the curb-idle stop. If not, warm up the engine and do the whole thing over again.



The fuel filters of the Escort and K-cars (Escort, shown above) will never need replacement, according to the manufacturers. The K-car air filter (right) needs to be replaced every 52,500 miles.

AIR FILTER AND FUEL FILTER SERVICING

Model	Service and Frequency
K-car	Replace air filter of K-car having 2.6-liter engine every 30,000 miles; of K-car with 2.2-liter engine every 52,000 miles (1). Fuel filter: no scheduled maintenance (2).
E/L	Replace air filter every 30,000 miles (1). Fuel filter: no scheduled maintenance (2).
X-body	Replace air filter every 30,000 miles (1). Replace fuel filter every 15,000 miles.

Footnotes: 1. More often in dusty conditions.
2. Replace fuel filter when there's a chance that a clogged filter is causing fuel starvation. The engine will falter, be hard to start or won't start.



Crankcase emissions filter in Escort and X-body cars are replaced every 30,000 miles (left, Escort). K-car idle speed is adjusted by idle-speed solenoid (right).



CRANKCASE EMISSIONS SYSTEM

Model	Service and Frequency
K-car	Clean and lubricate crankcase inlet air cleaner every 52,000 miles—more often if engine is run for long periods at extended idle, in stop-go traffic or for short runs.
E/L	Replace crankcase emissions filter inside the carburetor air cleaner every 30,000 miles—more often under dusty conditions.
X-body	Replace PCV valve and PCV filter inside carburetor air cleaner every 30,000 miles.

For X-body service, on an automatic transaxle, smear engine oil on the shift linkage that extends from a column shift to the transaxle. On a manual transaxle, smear water-resistant EP chassis grease on shift-linkage pivot points at transaxle.

Crankcase emissions

The K-car PCV valve is in an unusual place—in a small box on the side of the engine. PCV valves of other cars are seated in valve covers. The K-car PCV valve does not have to be replaced at a prescribed interval, but check it occasionally by shaking it. If you don't hear rattling, replace the valve.

Wash the K-car crankcase inlet air cleaner in kerosene. Then invert the part, fill it with SAE 30 engine oil and hold it upside down to let oil drain through the vent nipple on top of the cleaner.

The E/L has no PCV valve. Crankcase emissions are routed through engine passages to the cylinders for burning. Replace the small crank-

case emissions filter in the carburetor air cleaner with Ford crankcase emissions filter No. E1FZ9D695B or Motorcraft FA712.

Carburetor service

Apply carburetor solvent to the choke shaft where it passes through the air horn. Move the choke plate back and forth to distribute solvent. Also apply it to the fast-idle cam and pivot pin to remove oily accumulation that may cause sticking.

According to A.J. Ramming, Chrysler serviceability specialist, once the carburetor idle-speed adjustment is made, it should be set for the life of the carb. The adjustment should have been made at the factory, but if idle speed doesn't seem right, it is simple to adjust except for one drawback. The work should be done with propane equipment to keep emissions within EPA limits. If you don't have it, let a professional mechanic do the job.

The K-car idle adjustment *can* be performed successfully without pro-

pane equipment. The engine will run fine, but may be slightly "dirty" emissions-wise. Make the adjustment (with engine and thermostatic fan running) by means of the idle-speed solenoid on the carburetor. A cutout has been designed in the air-cleaner cover specifically for this adjustment with the cover in place.

Remove the idle-speed solenoid screw and spring, counting the revolutions it takes to get the screw out. Insert an Allen wrench in the solenoid and make the adjustment. Then replace screw and spring, turning screw the same number of revolutions it took to remove it.

Setting the E/L idle speed at specified intervals is a procedure you can do yourself. The idle-speed screw on the carburetor's firewall side is a bit hard to reach. Use a stubby screwdriver.

If you are adjusting idle speed with a cold engine, release the choke by applying a 12-volt charge for two minutes to the electric choke terminal. It's simpler to adjust idle speed after engine warm-up.

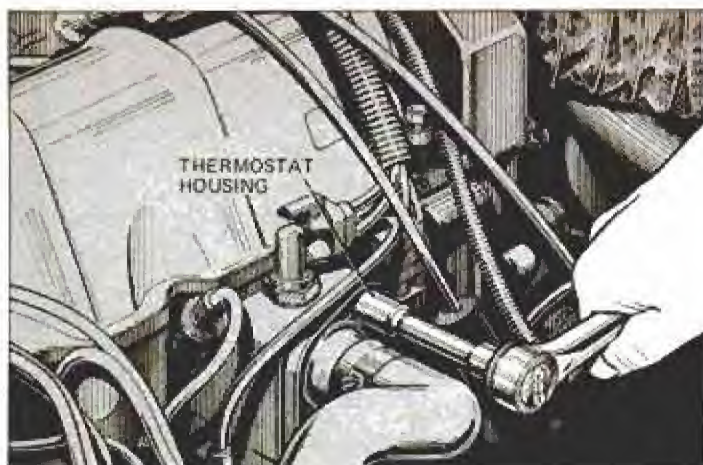
The emissions-control decal in the engine compartment tells what rpm specification you should set idle speed to. Use a tachometer.

For X-body idle speed, do this:

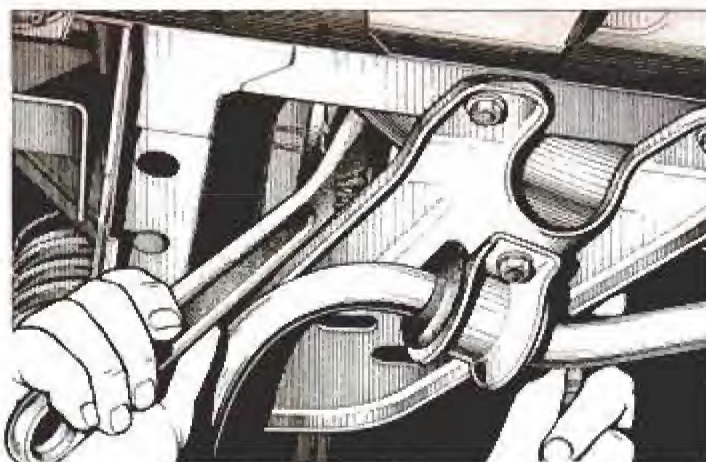
1. If the car has one, keep the air-conditioner off and set curb-idle rpm by turning the carburetor idle-speed screw. Use a tachometer and check the engine's emissions-control decal for the specification. Then disconnect the airconditioner lead at the compressor and turn on the airconditioner. Put an automatic transmission in Drive; a manual unit in Neutral. (Note: Before you put the automatic in Drive, make sure the

SERVICING THE CARBURETOR

Model	Services and Frequency
K-car*	Clean and lubricate carburetor parts every 30,000 miles. See below.
E/L	Check idle speed at 10,000 miles, at 30,000 miles and then every 30,000 miles. Clean and check choke-system linkage for freedom of movement every 30,000 miles. See below.
X-body	Check throttle linkage for damaged and missing parts, interference and binding every 12 months or 15,000 miles. Check choke and vacuum-break operation at first six months or 7,500 miles, and every 45,000 miles thereafter. Tighten carburetor mounting bolts and adjust idle speed at first six months; every 24 months or 30,000 miles thereafter.



The thermostat housing of the K-car is located at the side of the block. It's a snap to remove and install a new thermostat.



The only way you can adjust drive belts of the Escort is to get beneath the car. This is a very awkward and annoying task.

parking brake is fully engaged. Same goes for the car in Neutral.)

Open the throttle slightly so the idle-stop solenoid plunger extends fully. Turn the solenoid screw to the solenoid rpm specified on the emissions-control decal.

2. If the car doesn't have airconditioning, place an automatic transmission in Drive and a manual transmission in Neutral. Open the throttle slightly so the idle-stop solenoid plunger extends fully. With engine running, turn the solenoid screw until the tachometer records the curb-idle rpm listed on the emissions-control decal. Then disconnect the electric lead from the solenoid and turn the carburetor idle-speed screw until the basic idle rpm on the decal is recorded on the tach. Reconnect idle-stop solenoid lead.

A K-car "plus" is the ease of replacing the cooling-system thermostat in a housing on the side of the engine.

The K-car alternator drive belt is in a confined work area, so watch your knuckles. To adjust this belt, loosen the lock bolt under the alternator. Turn down the adjusting bolt with a $\frac{1}{16}$ -inch socket until the belt has $\frac{1}{4}$ to $\frac{1}{2}$ inch free play.

The K-car airconditioner compressor belt is also relatively easy to adjust. Loosen lock bolts on top of and under the compressor, push back against the compressor with a pry bar until the belt is tight and tighten the bolts.

The K-car power-steering pump belt is another matter. You have to loosen three lock bolts in tight quarters and pull back on the pump.

The Escort/Lynx has a unique coolant drain plug, a 1-inch-long nipple to which you attach a $\frac{1}{2}$ -inch i.d. vacuum hose. Direct the hose into a bottle to catch old coolant.

The E/L coolant-recovery reservoir and windshield-washer units are in one tank having two compart-

ments. Don't confuse them when adding fluid. The washer tank has a large cap; the coolant-recovery tank is covered by a small grommet.

Adjusting drive belts on the E/L is a dog. For each, you have to loosen the particular bracket and pivot bolts from inside the engine compartment, use an adjustable wrench and extension under the car, and then tighten bolts from inside the engine compartment. Ford recommends a \$20 belt-tension gauge.

Drive belts of the X-body are easy to adjust, except for power steering. To adjust or replace the alternator belt, for example, loosen three bolts—one on top, one behind and

one below the bracket. Insert a wrench in the adjustment slot and tighten. Other belts are adjusted similarly.

Summing up

Which car is easiest to maintain? Since the X-body was first to appear, it's at a disadvantage. Chrysler and Ford adopted many worthwhile X-body design features and improved on others. So the K-car and E/L are virtually neck and neck.

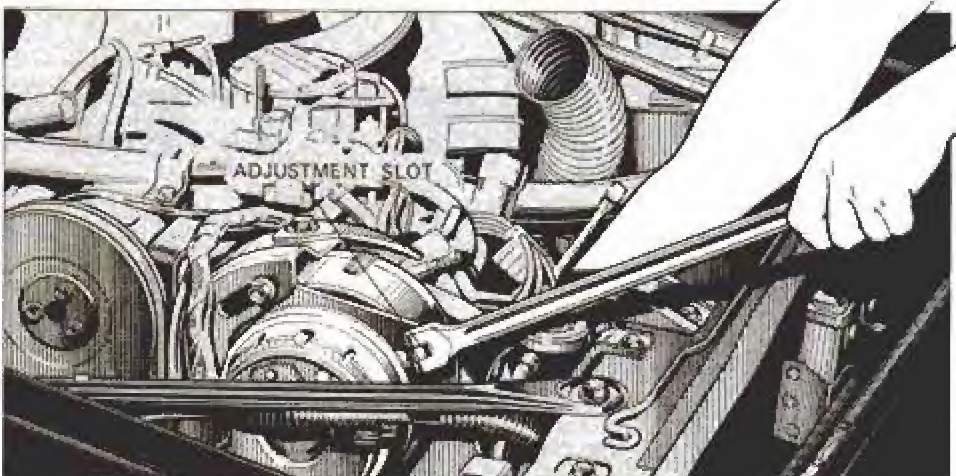
But wait till this spring when GM introduces the J-car. We'll bet it incorporates all the easy maintenance features of the K-car and E/L, and then some.

PM

COOLING SYSTEM AND DRIVE-BELT SERVICE

Model	Service and Frequency
K-car	Drain, flush and refill cooling system at 36 months or 52,500 miles, and every 24 months or 30,000 miles thereafter. Inspect drive belts for damage and adjust belt tension every 30,000 miles.
E/L	Drain, flush and refill cooling system at 36 months or 30,000 miles. Inspect drive belts for damage and adjust belt tension at 10,000 and 30,000 miles, and every 30,000 miles thereafter.
X-body	Drain, flush and refill cooling system at 24 months or 30,000 miles. Inspect drive belts for damage and adjust belt tension every 12 months or 15,000 miles.

Of the three cars, the drive belts of the X-bodies are the easiest to adjust. A slot is provided in the alternator bracket to tighten the belt.



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Q. What do I have to do to get this protection plan?

A. When you buy a new car, light truck or van from a participating dealer, you'll get the protection plan. To keep it in effect, all you have to do is follow these 4 steps:

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Q. What won't the guarantee cover?

A. It won't cover defects in manufacture, vehicles used in competition such as racing, damage caused by negligence, collision or abuse, improper installation, or engine parts not lubricated by motor oil.

Q. Suppose something goes wrong and I'm covered. What do I have to do, and how long will it take for me to collect?

A. All you have to do is notify Quaker State of a claim, by writing or calling collect. (Address and phone number are on the warranty.) Our claim representative will contact you within 24 hours. Provide the claim representative with a copy of your warranty, copies of your service records, and a statement of damage and repair cost from the dealer or any repair shop you choose. If everything is in order, the claim representative will approve the claim and make the payment.

Q. If I don't have a brand new car, can I still get the Protection Program?

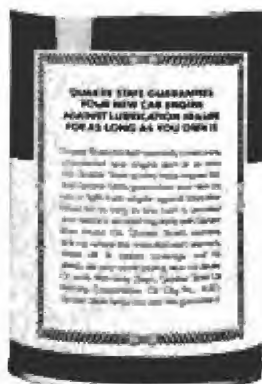
A. If your car has under 6,000 miles, you can switch to Quaker State and qualify for the Protection Program at a participating new car dealer's service department. But if your car has more than 6,000 miles, it can't qualify.

Q. If I buy a new car now, and keep it for 100,000 miles or more, will this Quaker State Protection Program be good for that long?

A. Yes. Lifetime really means for as long as you own your new car—even if you keep it for a lifetime. After all, thousands of people are already driving over the 100,000 mile mark using Quaker State without this protection program. Now, you can do it with Quaker State and have this *extra* protection for as long as you own your new car.

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A comparison of projections from manufacturers' treadwear ratings under the new government Uniform Tire Quality Grading System indicates that on a government-specified course:

Michelin fell a little short of the Uniroyal Steeler. About 24,000 miles short.

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When compared, Michelin's XWW fared somewhat better than Uniroyal's comparable Steeler in the traction and temperature resistance tests.

But when it came to the important grade that indicates the relative wear rate of your tire, Michelin's tire fell a little short. In fact, when you translate their ratings into projected miles on the government-specified test course, you see it was no photo finish.

On that course, the mileage projection for Uniroyal's Steeler is 66,000 miles. 24,000 miles longer than Michelin's rating projects.

(And, by the way, 15,000 miles longer than the projections from the ratings of the Goodyear, Goodrich, General and most Firestone tires in the chart.)

These mileage projections (including those in the chart) should be used for comparison only. You will probably not achieve these results. Actual treadlife will vary substantially due to your driving habits, condition of vehicle and, in many sections of the country, road conditions and climate.

See your Uniroyal dealer for details.

You'll see there may be a new yardstick to compare tires by.

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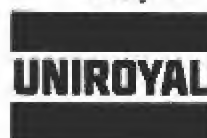
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FIRESTONE 721 (13" & 14" sizes)	B/C	170*	51,000
GENERAL Dual Steel II	B/C	170	51,000
B.F. GOODRICH Life Saver XLM	B/C	170	51,000
MICHELIN XWW	A/B	140	42,000

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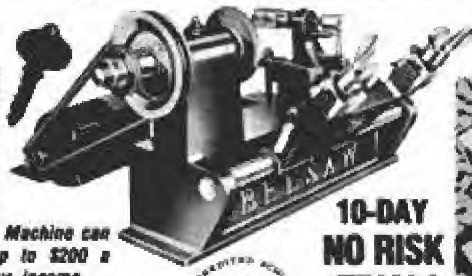
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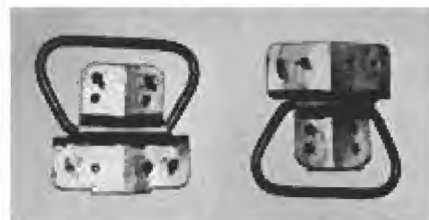
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HINTS FROM READERS

Tool holders on a ladder



Remove handles of metal garbage cans.

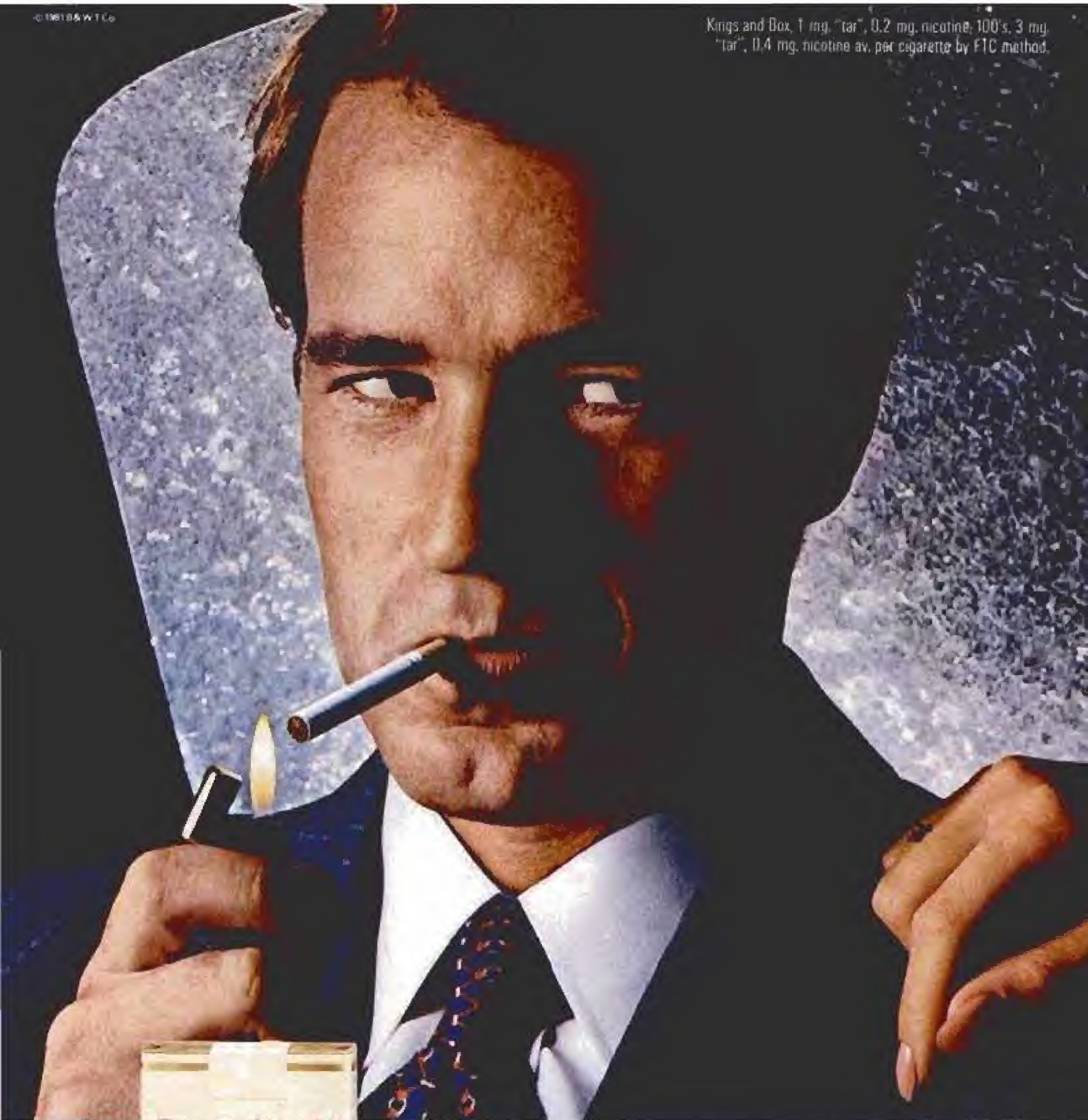


Garbage-can handle keeps tools handy.



Holder is good for odd-shaped tools.

Chisel the handles off an old metal garbage can and rivet them to the sides of an aluminum ladder. The handles make convenient tool holders when you're doing around-the-home jobs that call for using tools while on a ladder. To attach a handle, bore holes for 1/8-in.-dia. Pop rivets through the flat area (backplate) where it was fastened to can. File burred spots smooth.—**E. V. Reyner**



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Burglars seek easy targets. Few have the daring or the knowledge to challenge the new Perim-A-Tron™ Home Security System. No other burglar alarm under \$2,000 can give you more protection...or match it for features that will give you and your family safety and peace of mind. For starters, it is wireless, installs in minutes, and is portable should you ever move.

THE BRAIN VS. THE BURGLAR

Perim-A-Tron's™ central console, or "BRAIN", employs a microprocessor, making it the most advanced security system available for consumer use. With Perim-A-Tron™ on duty, small sensors monitor doors and windows ready to signal the "Brain" from as far as 250 feet, in the event of a break-in attempt. The "Brain" processes each signal instantaneously and sounds not only a self-contained 85db internal alarm, but also a second 95db remote siren to augment the inside alarm or for placement outside to alert neighbors and police.

The Perim-A-Tron™ is so easy to live with that pets can come and go through partly-open windows or sliding glass doors without triggering it, yet so vigilant that an intruder will set it off before he can enter.

THOUSANDS OF OPTIONS

Perim-A-Tron's™ micro-computer lets you choose from thousands of three digit disarm codes. Only you know your code. But if your son's friend receives a "demonstration", you can easily change the code again...and again. You need no specially coded key which can be lost, misplaced, or stolen. The system even has two separate channels, each with its own distinct alarm sound. This feature allows you to zone your system. For example: Channel 1—house, Channel 2—garage, or Channel 1—doors, Channel 2—windows.

HOW IT WORKS

Operating the system is simplicity itself. When leaving, a light on the console tells you that you've armed the system properly, and have from 5 to 45 seconds to leave the house. This variable delay feature, not found on some expensive commercial systems, is selective so that it can apply only to frequently used doors. All other openings would be set for instant alarm. Upon returning home, you have ample time to turn the system off, thereby avoiding a false alarm.

If a break-in attempt occurs while you're away, an alarm memory light on the console tells you so. What's more, after sounding for

**Perim-A-Tron's™ 26
button keyboard gives you
protection a \$2,000 commercially installed
system can't beat. Includes powerful remote horn.**

10 minutes and scaring away the intruder, the system shuts off automatically and re-sets itself.

A CONSTANT GUARDIAN

Leave Perim-A-Tron™ in Test Mode during the day and it will signal when anyone leaves or enters. This thoughtful signal will not operate the remote horn but gives a 2% second warning on the internal speaker only.

If power fails (or is cut-off), the console has a battery back-up. And each battery powered transmitter/sensor will signal at the console if the battery runs low.

The Perim-A-Tron™ system is highly resistant to false alarms because it is not sensitive to motion or sound. Pets can roam at will, curtains can blow in a breeze, you or your children can visit the kitchen for a midnight snack—all without setting off an alarm.

COMING HOME SAFELY

There is nothing more frightening than finding a prowler lurking near your house when you arrive home at night. Our system's EXTRA PROTECTION DESIGN lets you carry a transmitter in your pocket, purse or glove compartment (it's about the size of a cigarette pack). With simple modification, it serves as a PANIC device and will set off the alarm at the press of a button.

COMPARE IT

Hard-wired "commercial" burglar alarms can cost \$2,000 PLUS a monthly fee (and you still never own it). Motion and sound detectors cost up to \$200 per unit and cover only limited areas. Your home may require two or three of these units and, in most cases, no alarm will sound until AFTER a prowler is inside for 30 seconds or more. Perim-A-Tron™ combines pre-entry protection with micro-electronic circuitry to provide the most protection at the lowest cost.

U.L. APPROVED

The Perim-A-Tron™ Home Security System is listed by Underwriters Laboratories as a burglary protection device, a rating which goes beyond electrical safety. To earn this listing our alarm was thoroughly tested for critical burglary protection functions such as transmitter range, sound volume, battery back-up, keyboard component life, battery failure warning, and test function. This tough-to-get U.L. listing resulted from the exacting standards engineered into the Perim-A-Tron™.



YOU BE THE JUDGE

We urge you to order just the basic Perim-A-Tron™ system (pictured above) for a 30-day trial period. Use it to protect your family while you sleep and to protect your home while you're away. Then if you're not convinced that the Perim-A-Tron™ is the most advanced, efficient security system available today, return it undamaged for a complete, no-quibble refund—including return postage. You are protected by a 90 day manufacturer's warranty as well as Shelburne's 25 year reputation for satisfied customers.

HERE'S HOW TO ORDER

To order simply send your check for \$199.95 plus \$4.50 for shipping and handling to the address below. Credit card holders can speed delivery of their system by using our toll-free number listed below. We will then promptly ship your Perim-A-Tron™ unit complete with easy-to-understand instructions and decals warning that the premises are protected. Additional transmitters are available for \$29.95 each, but one is not required for every door and window. Instead, magnetic contacts can be purchased and easily connected to the transmitter, allowing you to cover additional openings for as little as \$5 each. The instruction booklet is quite useful in helping you determine the correct combinations to protect your home or office at the lowest possible cost.

Give yourself some peace of mind—order a Perim-A-Tron™ today at no obligation.

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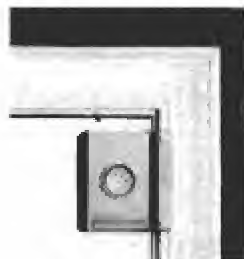
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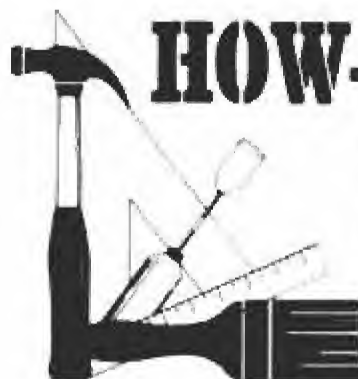
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This photo shows a transmitter & magnet installed. If a break-in attempt occurs, separating the two, the transmitter sends a signal to the console which sounds an alarm to scare away the burglar. Installation takes only a few moments & doesn't even require a screwdriver.



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"IN TWO AND A HALF YEARS OF CRABBIN', I PUT MORE HOURS ON THIS MARINER THAN MOST FISHERMEN WOULD LOG IN A LIFETIME".

James A. Crum, East Point, Florida

Mariner was new to the United States when James Crum bought his motor back in July of 1977. He had worn out plenty of outboards in 19 years of crabbing out of East Point. As he says, "Crabbers expect 8 months from a motor, and if you get a year, you've got a good one."

Two and a half years later, his battered Mariner is still getting him to and from a couple hundred crab pots a day. Starting. Stopping. Full throttle to close; 200 times a day. It runs 6½ hours a day, 7 days a week except for bad weather. In all the time he's owned it, it's been in the shop just twice for minor repairs.

We figure Mr. Crum has put more hours on his Mariner than the average sport fisherman or recreational boater would log in 50 to 60 years!

The outboard that has already proven itself on four continents is proving to U.S. boaters that Mariner really is better in the long run.



For a catalog of Mariner Outboards from 2 to 200 h.p., write Mariner, Dept. PM4, 1939 Pioneer Road, Fond du Lac, WI 54935. Or call toll free 800-558-9758. In Canada, write Mariner, 1156 Dundas Hwy., E. Mississauga Ontario L4Y 2C2.

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ALL OUTDOORS

DAN for divers

One of the most appealing of adventure sports is underwater exploration, but about 125 people die from it every year. Major causes are gas embolism, causing bubbles in the bloodstream, and decompression sickness, known as "the bends." Both conditions may be misdiagnosed as a stroke, since the symptoms are similar. Too many fatalities occur because a hospital lacks the recompression chamber needed for immediate treatment.

Now a nationwide telephone hot line, called the Diving Accident Network (DAN), has been set up by the Commerce Department's National Oceanic and Atmospheric division, the National Institute for Occupational Safety and Health, and the Department of Energy. Call (919) 684-8111 for advice from doctors and rescue squads, plus information on arranging emergency transportation to the nearest facility that can treat diving accidents. Regional centers are located in Seattle, Honolulu, Milwaukee, New Orleans, Philadelphia, Santa Barbara, Calif., and at Duke University in Durham, N.C. All seven have recompression chambers.

Bug off

It's no longer a secret that a lot of people hate the outdoors because they've heard that's where the bugs live. Sporting goods stores and drugstores now stock Muskol, Deep Woods Off, Cutter, 6-12 and other effective insect repellents. Recent additions worth testing are Seidel's 400, made by T.R. Seidel, Arvada, Colo., and Skeeter Stik, by Outdoor Recreation Products, Cleveland, Wis. The 400 lotion is reported to do triple duty as a sun screen, repellent and poison-ivy irritation preventive. It also won't harm fishing lines and plastic sunglasses and tackle boxes, it's claimed, as some products do. Skeeter Stik comes in a pen-sized applicator that can treat up to 1,000 insect bites and stings.

Old-time outdoorsmen claimed that going a month without a bath, rolling in mud and standing downwind of a smoky fire would help. Modern sportsmen would do well to check locally, since one spray or lotion may work better in one region and on one particular skin than another. Some sting allergies can cause violent reactions, so before an extended trip, check with your doc-

tor. Some drugstores are reluctant to fill prescriptions from an out-of-state address.

New for boatmen

A whole new trend in compact commercial craft should benefit pleasure-boat buyers, as well. In the past, boats for business have been heavy, rugged, no-frills jobs, while runabouts and cruisers have been lighter, faster and fancier. But both have been found to burn up too much expensive fuel. Now the best features of both are being combined.

The weight and expense of a big gasoline or diesel powerplant didn't seem to matter so much when gas cost only a quarter a gallon. Pushing



Newest from Boston Whaler, the Frontier 25 combines both work and pleasure features.

a large-displacement hull through the water was part of tradition. Meanwhile, commercial fishermen in other parts of the world were finding they could switch from sail to power by using smaller boats and larger outboard motors. Developing countries could continue to employ water transportation without building expensive roads and buying costly trucks.

Mariner outboards, originally developed as heavy-duty engines in Australia, earned such a reputation for reliability that they have been able to expand to 19 models that run from 2 to 200 hp. American and Japanese outboards are seen in the remotest regions of South America, Asia and Africa. And now Outboard Marine is announcing Evinrude and Johnson motors aimed at the muscle market.

The new Johnsons will be called Workhorse instead of Sea-Horse engines. Evinrudes arrive as Workwin models. Both will first appear as 25-hp, 40-hp and 55-hp mills with long-handle tiller steering, rope-pull

start and 50-to-1 gas-to-oil or 30-to-1 kerosene-to-oil models. Remote controls, up-front steering and electric start will be fancy options that can be ordered, but are not necessary for dependable performance. Heavy-duty fuel filters and water pumps, plus lateral fins on the lower-unit gear case to help protect the propeller, are additional engine features.

And Boston Whaler, famous for its rugged, unsinkable, expensive skiffs, is introducing a 25-foot workboat that should serve well as a cargo craft, lobster boat or water taxi. With an eight-foot beam, this new Frontier 25 can be trailered. The Vee Whaler hull should give an easy ride, and outboards up to 300 hp can provide plenty of speed.

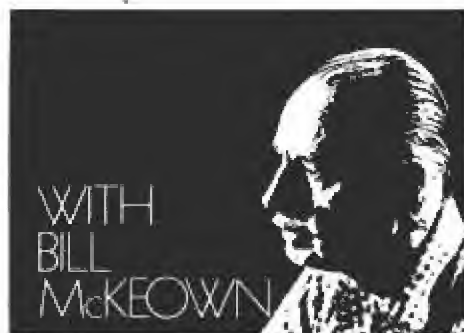
A small wheelhouse forward has standing headroom, and the 7½×10-foot deck aft offers open work space. For heavy-duty use, the husky fiberglass hull has been additionally beefed up and carries a 10-year warranty. The Frontier 25 appears to combine some of the best features of both a pleasure and a commercial craft.

Stripping down

Taking a gun apart to clean it and then, especially, trying to get it back together again can seem like a puzzle that has been created by sinister designers.

Now DBI Books of Northfield, Ill., has come to the rescue with a set of five excellent *Firearms Assembly/Disassembly* volumes at \$8.95 each. Extensive photos show how to field-strip or completely take down 41 of the most popular autoloaders in *Part I: Automatic Pistols*; volume II covers 32 revolvers; 38 rimfire .22 rifles are illustrated in III; the 33 top centerfire rifles are in volume IV; and 26 shotguns are featured in detail in V.

Best of all, however, the books show exactly how all 170 guns can be reassembled. **FM**





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a true story by John B. Haikey

Starting with borrowed money Duraclean gave me the opportunity for financial security...
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"Not until I was forty did I make up my mind that I was going to retire before ten years had passed. I knew I couldn't do it on a salary, no matter how good. I knew I couldn't do it working for others. It was perfectly obvious to me that I had to start a business of my own. But that posed a problem. What kind of business? Most of my money was tied up. Temporarily I was broke. But, when I found the business I wanted I was able to start it for a small amount of borrowed money.

"To pyramid this investment into retirement in less than ten years seems like magic, but in my opinion any man in good health who has the same ambition and drive that motivated me, could achieve such a goal. Let me give you a little history.

"I finished high school at the age of 18 and got a job as a shipping clerk. My next job was butchering at a plant that processed boneless beef. Couldn't see much future there. Next, I got a job as a Greyhound Bus Driver. The money was good. The work was pleasant, but I couldn't see it as leading to retirement. Finally I took the plunge and went into business for myself.

"I managed to raise enough money with my savings to invest in a combination motel, restaurant, grocery, and service station. It didn't take long to get my eyes opened. In order to keep that business going my wife and I worked from dawn to dusk, 20 hours a day, seven days a week. Putting in all those hours didn't match my idea of independence and it gave me no time for my favorite sport — golf! Finally we both agreed that I should look for something else.

"I found it. Not right away. I investigated a lot of businesses offered as franchises. I felt that I wanted the guidance of an experienced company — wanted to have the benefit of the plans that had brought success to others, plus the benefit of running my own business under an established name that had national recognition.

"Most of the franchises offered were too costly for me. Temporarily all my capital was frozen in the motel. But I

found that the Duraclean franchise offered what I had been looking for.

"I could start for a small amount. (Today, only \$2,588 starts a Duraclean dealership, and the company will finance the balance of the \$7,895 cash investment over 45 months.) I could work it as a one-man business to start, and operate from my home. No office or shop or other overhead, no salaries to pay. Equipment would fit in my car trunk. (I bought the truck later, out of profits.) Best of all, there was no ceiling on my earnings. I could build a business as big as my ambition and energy dictated. I could put on as many men as I needed to cover any volume. And I could build little by little, or as fast as I wished.

"So, I started. I took the wonderful training furnished by the company. When I was ready I followed the simple plan outlined in the training. During the first period I did all the service work myself. By doing it myself, I could make much more per hour than I had ever made on a salary. Later, I would hire men, train them, pay them well, and still make an hourly profit on their time that made my idea of retirement possible — I had joined the country club and now I could play golf whenever I wished.

"What is this wonderful business? It's Duraclean. And, what is Duraclean? It's an improved, space-age process for cleaning upholstered furniture, rugs and tacked down carpets. It not only cleans but enlivens and sparkles up the colors. It does not wear down the fiber or drive part of the dirt into the base of the rug as machine scrubbing of carpeting does. Instead it *lifts out* the dirt by means of an absorbent dry foam.

"Furniture dealers and department stores refer their customers to the Duraclean Specialist. Insurance men say Duraclean can save them money on fire claims. Hotels, motels, specialty shops and big stores make annual contracts for keeping their carpets and furniture fresh and clean.

"Well, that's the business I was able to start with such a small investment. That's the business I built up over a period of eight years. And, that's the business I sold out at a substantial profit before I was fifty."

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Staying alive on two wheels

If you ride a motorcycle, the odds of crashing are uncomfortably high. But, by using the results of a revealing accident study, you can beat the odds and avoid denting your bike—or yourself.

by Bill Hampton and Bill Stermer

Unlike automobile accidents, motorcycle accidents had never been seriously studied until recently. There are literally libraries full of automobile statistics that cover every possible factor and circumstance of what happens when cars crash. Yet, until Dr. Harry Hurt began conducting his Motorcycle Accidents Factors study, not one shred of hard information existed. Yes, there were numbers on the dead and wounded, but not much else.

For the motorcycle rider Hurt's report will become something of a survival manual. It should be required reading for anyone getting a motorcycle license.

Dr. Hurt and his staff at the University of Southern California based their study on the critical analysis of 899 motorcycle accidents. Almost all the information was gathered at the scene of the accident and within 24 hours of the accident. Interviews with the drivers, riders and wit-

nesses determined time of day, location, weather conditions, age of rider, experience, and so on.

Motorist at fault

Perhaps one of the most startling statistics to have come out of this study is that motorists cause over half (51 percent) of all motorcycle accidents. The motorists in this instance violated the motorcyclists' right of way. The classic example of this is the motorist making a left turn in front of an oncoming motorcyclist at an intersection.

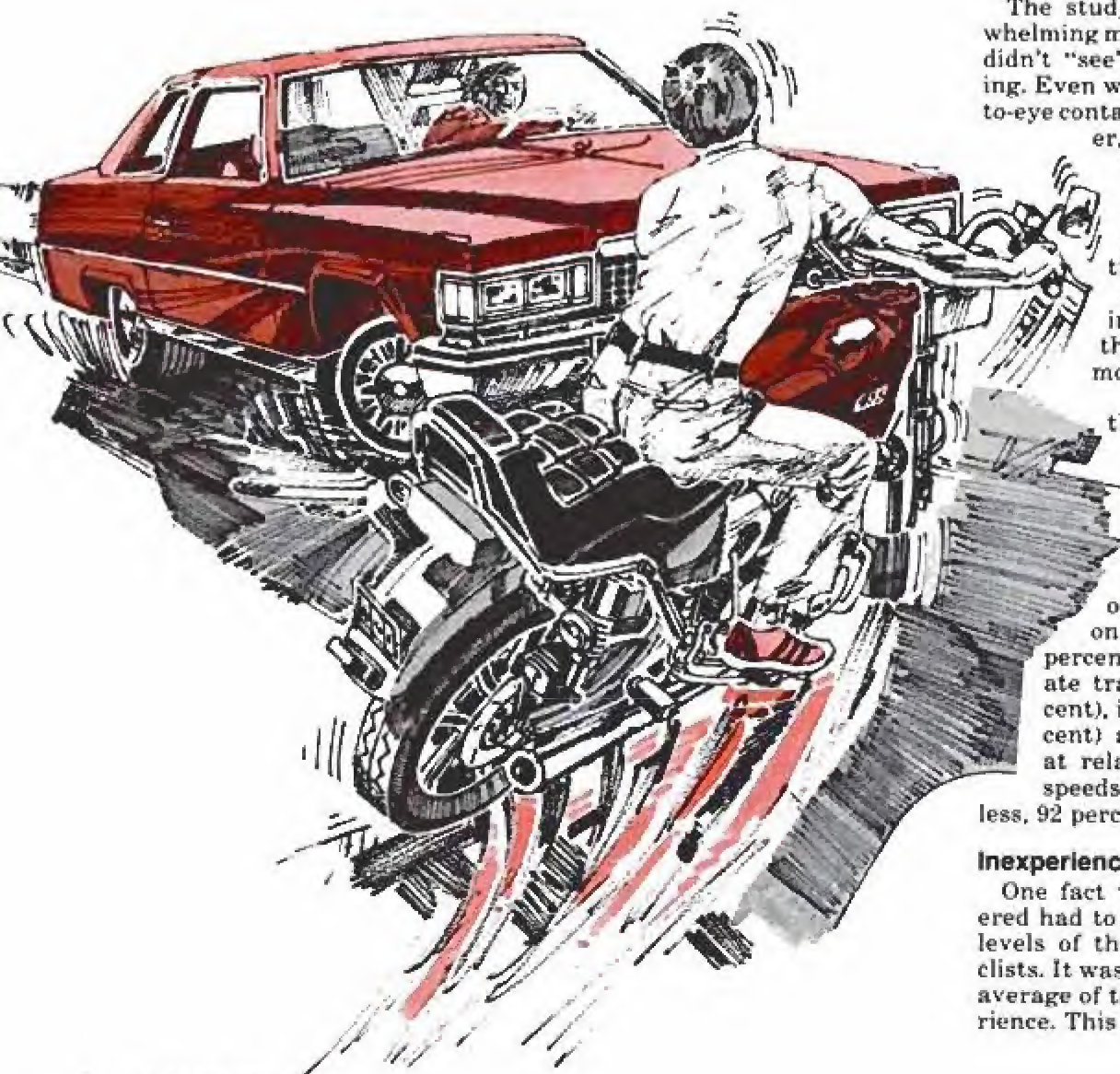
The study found that the overwhelming majority of drivers simply didn't "see" the motorcyclist coming. Even when a driver makes eye-to-eye contact with a motorcycle rider, it still may not register that something is bearing down on him. Most drivers are just naturally programmed to notice only vehicles as big as those they are driving. In many instances, this "mind set" is fatal to motorcyclists.

Interestingly enough, this inability of the driver to see a motorcycle coming had nothing to do with poor visibility or bad weather conditions. Of all the accidents studied, 75 percent occurred during daylight, on dry road surfaces (96 percent), under light or moderate traffic conditions (85 percent), in good weather (98 percent) and, most significantly, at relatively slow motorcycle speeds (78 percent at 30 mph or less, 92 percent at 40 mph or less).

Inexperienced riders

One fact the researchers discovered had to do with the experience levels of the accident-involved cyclists. It was found that they had an average of three years' riding experience. This fact conflicted with the

(Please turn to page 79)



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Great for learning to program and operate a computer, with all kinds of features built in for students, hobbyist, the professionals, small business and homeowners. It has a powerful 8080A Intel microprocessor brain. 16K Dynamic RAM, 2K ROM, Real time, a High Speed Cassette Deck that operates at 1500 Baud; loads and reads 5 times faster than most compacts, it has a full 53 typewriter layout keyboard. The graphics are 8 colors with 77 x 112 resolution, text display is 12 lines of 17 characters, it also has sound and color, includes an AC adapter, power cord, R. F. modulator, TV switch box and 8' connector cable. It is FCC, CSA approved and UL listed. All this built into an attractive black console plastic case. Comes in a sturdy shipping carton that measures 20" long x 12" wide and 8" depth. Weighs 16 lbs.

AN INCOMPARABLE SCHOOL TEACHER

Prepare yourself for the future! You can learn to operate and program a computer for job opportunities in the computer revolution. Our Level II basic is a version of Microsoft® and is equivalent to all Level II Programs currently available. This basic includes a super set of operations in floating point with integer and string arrays, direct memory access, PEEK and POKE, direct statement execution, two character variable names, user definition functions, multi-statement lines, editing, scrolling, file management and more! 8080A MACHINE LANGUAGE AND EDITOR PROGRAMS ARE AVAILABLE.

Since the computer can talk, play music and perform in color IT IS A PHENOMINAL TEACHER. You can now use the TV to EDUCATE not frustrate your family. You will eliminate TV boredom with programs that challenge, stimulate and entertain you. Create your own programs or select from over 30 programs offered. IT IS A BRILLIANT MUSIC TEACHER. You can practice on the piano keyboard overlay, select key and tempo, write a tune and record. It has a great color art program, you can improve your memory, math, spelling, vocabulary and sharpen your strategy skills. IT IS A GREAT TUTOR FOR YOUR KIDS.

USE AS A BUSINESS TOOL

Although the Interact MODEL "R" is not designed for business, the Level II basic and the 16K Byte system give you room to write your own programs for individual business needs. We also offer these business programs: Calculator, Check Book Balancer, Stock Portfolio, Mortgage & Loan and Message Center.

IT ALSO PLAYS GAMES

A total entertainment center with color, sound, and music. There are Chess, Backgammon, Star Track, Black Jack, Volleyball, Touchdown, Hangman, Showdown, Computer Maze, Break-through and more! Challenge the computer or another opponent. Each game brings the family and friends together for hours of quality fun.

SERVICE AND WARRANTY

If the unit fails because of factory defect within 90 days of purchase, it will be repaired at no charge for labor and parts - you just send the unit United Parcel prepaid to the Service Center designated and it will be sent back to you promptly United Parcel prepaid! A complete Diagnostic program tape and instructions are available. You can get a Service manual, Cassette alignment tape, Schematics, and parts list plus a Money Saver Service and warranty Card. Everything you need to check and service your computer.

IT CAN BE EXPANDED AT LOW COST

It is a single board computer. RS232 Interface is available now at \$99.50 for adding printers and telephone modems. A telephone modem allows you to access "MICRONET", "SOURCE" and other data banks. You can also talk to other computers. Plans for expanding ROM and RAM capabilities are being considered. Our factory sponsored National Computer Club membership is available to learn from other owners the fantastic things you can do with this computer.

PRICE COMPARISON

Competitive 16K RAM Personal Computer Suggested List prices are: Radio Shack \$849, T. I. \$950, Atari \$1,125, Apple \$1,195, Ohio Scientific \$850. Radio Shack's TRS-80 that has only 4K RAM, no color, or sound, sells for \$499.

WHY SUCH A LOW PRICE

Selling on a factory direct to customer basis, we save you the profit normally made by computer stores and distributors. You also save the cost of a computer monitor as this computer is FCC approved and designed to hook up to any TV antenna terminal. We are willing to take a small margin at the factory to develop volume that allows lowest cost operation.

SPECIAL FACTORY SALE \$249.00

You get the Interact MODEL "R" computer that includes 16K RAM, 2K ROM, 8080A microprocessor, color, sound, full 53 key board, high speed cassette deck, power cord, AC adapter, connector cord rack, tape storage tray, 8' connector cable, R.F. modulator with TV switch box and owner's manual.

SPECIAL FACTORY PACKAGE SALE DEAL \$344.00

Everything you get for \$249.00 plus: LEVEL II DOCUMENTATION: Level II user's manual, Level II Basic Program Tape, Level II Command Cards, Level II Basic Examples Book. SERVICE AND WARRANTY PACK: Diagnostic Program Tape, Diagnostic Instruction Manual, Service Manual, Cassette Head Alignment Tape, Schematics and Parts List, Money Saver Service and Warranty Card. Two 8 AXIS ACTION CONTROLLERS with Pot Knob, Firebutton and Lever. PLUS THREE TAPE PROGRAMS. (Everything you need to learn to operate, program and service your computer.).

**FREE TRIAL OFFER - RETURN WITHIN
15 DAYS UNITED PARCEL PREPAID
COMPLETE AND UNDAMAGED FOR FULL
REFUND OF PURCHASE PRICE.**

DON'T MISS THIS SALE - ORDER NOW

- ☐ Please send me the model "R" 16K RAM computer for \$249.00.
- ☐ Please send me the SPECIAL FACTORY PACKAGE PRICE DEAL FOR \$344.00.

Add \$15.00 for shipping and insurance. Illinois residents add 6% tax.

ENCLOSE CASHIER'S CHECK, MONEY ORDER OR PERSONAL CHECK. Allow 14 days for delivery. 21 days for personal check orders, 10 days for phone orders.

We ship C.O.D. We honor Visa and Master Card orders.

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Keep it running like new with Popular Mechanics/Motor's *Tuneup & Troubleshooting*.

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So the *Tuneup & Troubleshooting* book keeps on saving you money!

It's fully illustrated, with step-by-step instructions in such clear and simple language that nothing's left to your imagination.

"Troubleshooting by the Numbers" makes diagnosing problems as easy as 1-2-3. It describes 28 symptoms in Troubleshooting Charts that tell what to do...and the section of this book that details how to fix it.

Keep it looking like new with Popular Mechanics/Motor's *Bodywork & Painting*.

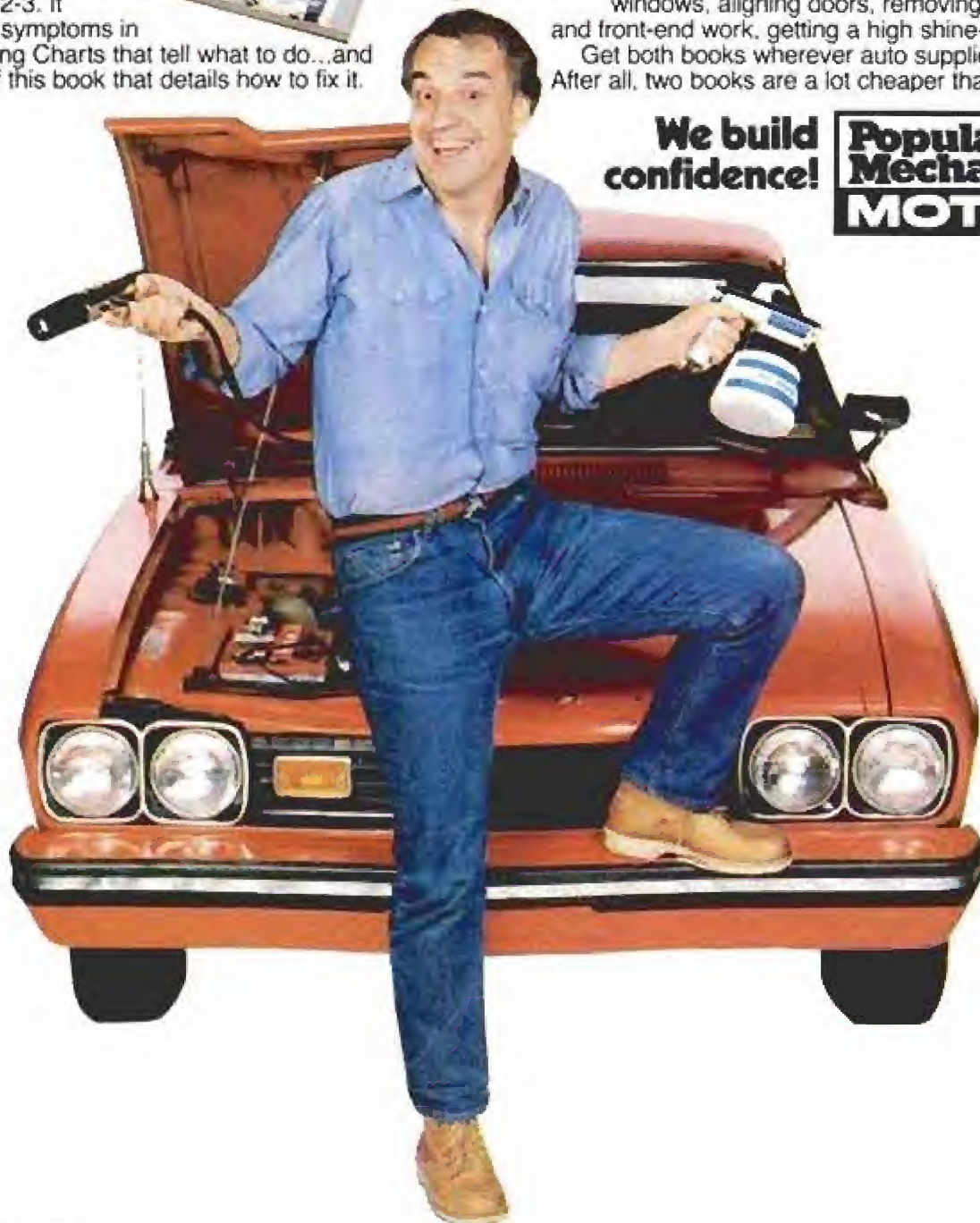
A little rust. A dent or ding. Some chips and nicks. Perhaps some peeling or cracking. And pretty soon your old car looks like...an old car. You can fix all that without paying body shop prices. You can do it—with this Popular Mechanics/Motor book and save a bundle!

Amplly illustrated Photosteps show you how it's done instead of just telling you. Everything's here—from patching rust spots and pulling dents to spray painting, touching up and custom techniques.

Includes vinyl roof repair, replacing antennas, chip-proofing, fiberglass repairwork, replacing and resealing

windows, aligning doors, removing rattles, rear- and front-end work, getting a high shine—everything.

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We build confidence!

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NRI can show you how to make money repairing small engines!

There's plenty of opportunity for the man who can service lawn mowers, garden tractors, chain saws, tillers, outboards, mopeds, motorcycles, snowmobiles and the like.



There're 50 million small engines out there, and many are waiting for qualified servicemen to fix them. NRI can give you the training you need to cash in on this opportunity, and you learn at home in your spare time, at your convenience.

Exclusive! Build Engine as You Learn

You learn by doing with NRI "hands-on" training. Only NRI gives you all the parts and training you need to actually build a 3 1/2 HP Clinton 4-cycle engine and learn from the inside out as you progress. And your training includes real *professional* tools, including an inductive tachometer, volt-ohm meter, torque wrench, valve spring and ring compressors, a full set of quality wrenches and more...all to equip you for learning and earning.

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NRI's basic course puts special emphasis on lawn and garden equipment, and teaches you the theory and practice of ignition, lubrication, cooling and starting systems.

Its 30 "bite-size" lessons concentrate on one subject at a time to let you move at your own pace, give you greater clarity and faster learning.

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America's oldest and largest home-study technical school, NRI has trained over a million students. And this experience means that you get the most in practical, effective training for your dollar. You get lessons

developed and tested by professional educators...expert help from instructors assigned to your course...a full set of quality tools...a complete, working engine that you build yourself...the best training and value for your money.

Find out for yourself how much NRI training can do for you. Send for the free catalog with all the facts and descriptions of every lesson. No salesman will call. Get started on your future today! If postcard has been removed, write to address below.

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America's winningest stock car racer says, "If you really want to learn how to repair cars, NRI is best." Includes professional tools like ignition analyzer scope, diagnostic engine analyzer, timing light, case hardened wrenches, and much more. Basic and advanced courses. Check postcard for catalog.

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Gets you into a wide-open, fast-growing area with practical training that includes lessons on solar heating, heat pumps, etc. Course is complete with professional tools and window air conditioning unit for demonstration and troubleshooting

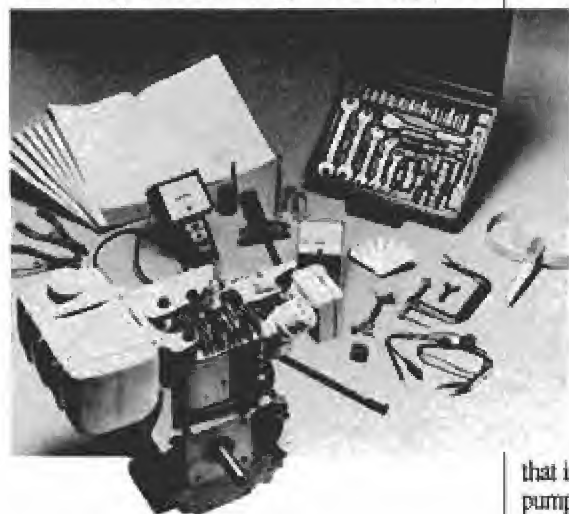
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Good appliance repairmen are hard to come by. NRI trains you for your own full or part-time business in fixing everything from toasters to refrigerators and freezers. Step-by-step training includes professional appliance tester for fast troubleshooting. Check card for catalog.



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A little something to help blow away inflation.

It'll take more than Gabriel blasting 40% off Red Ryder prices to blow away inflation. Even so, it's a healthy puff in the right direction.

Now you can save \$9.98 off* Gabriel's \$24.95 regular suggested retail price—on each Red Ryder shock absorber you buy.

If you were to buy all four Red Ryders, you'd stash away close to \$40. Besides giving your car Gabriel's best-selling shock absorbers.

Not only are Red Ryders heavy duty all

the way, they're now *computer tuned* all the way. To your tires. To the road. And to your car. For better control at higher speeds, greater comfort at lower speeds.

So here's to the 40% Off Sale. May it explode the myth that you can't give inflation a good shock.

Gabriel
On the road ahead.

Offer expires in a flash May 31, 1981.

Gabriel Shocks & Struts are products of Maremont Corporation.

*Based on Gabriel's suggested retail sale price of \$24.95 and the regular suggested retail price of \$24.95. Installation not included. Prices may vary at participating dealers.

popularly held belief that most cyclists who crash have less than six months' riding time.

Upon closer investigation, however, Hurt found that the typical accident-involved cyclist had less than five months' familiarity with his new machine at the time of his accident. This particular statistic is proof of the lack of proper training most motorcyclists receive before they set wheel to road.

A motorcycle is more demanding in its functions and operation than a dual-track vehicle. It takes proper training for a cyclist to become skilled enough to make his machine behave in a controlled, responsive manner.

And riding a *strange* motorcycle vigorously, no matter how experienced you are, as Hurt has proved, is "asking" for it.

In the accidents that Hurt had analyzed, he found that over half of the involved cyclists did not have a

Most drivers are just naturally programmed to notice only vehicles as big as those they are driving.

standard motorcycle operator's license. Of those, 10 percent did not even have a regular driver's license. Another disturbing fact was that 92 percent of the hundreds of accident-involved motorcycle riders had been taught by friends or family members, not by someone specifically trained in motorcycle-operation skills.

Poor braking ability

One area of riding skills in which Hurt found cyclists lacking was braking technique. Many of the victims had never really mastered the art of braking a two-wheeler in the shortest distance possible.

After careful analysis of hundreds of accidents, it was found that most of the hapless bikers did not know how to use the front brake effectively. And it's the front brake that provides up to 75 percent of a motorcycle's stopping power.

In most of the intersection accidents, the cyclists jumped on the rear brake and under utilized the front brake. This caused the rear brake to lock up, the rear tire to skid and the rider to lose control of the motorcycle.

The study points out that, while proper use of the front brake would not have necessarily prevented the accident, it would have reduced the speed of the motorcycle before im-

Tips for staying healthy

■ **Keep off the center of the lane.** Ride off center and to the driver's side of the car in front. This will keep you in his rear-view mirror. The center of the lane is also saturated with oil, gas and radiator coolant drips. It's very slippery in the rain.

■ **Know your machine.** The mechanical condition of your motorcycle is critical. Keep your chain lubed and inspect it often. Check the condition of the tires and keep them inflated to the right p.s.i. Also check your brakes and lights regularly.

■ **Look ahead.** Don't concentrate on the road immediately ahead. Look as far down the road as possible and scan for potentially dangerous situations.

■ **Wear the right clothes.** Don't ride with a T-shirt and sneakers. Wear gloves, heavy shoes or boots and *always* wear a helmet.

■ **Keep your lights on.** Even in the daytime your lights should be on. If your headlight is weak, replace it with a halogen-type lamp.

■ **Use the horn.** Don't hesitate to sound off if you suspect that a motorist or pedestrian doesn't see you. Buy the loudest horn you can find and use it.

■ **Use turn signals.** Don't make anyone behind you guess your intentions. Ride with the attitude that you are invisible. Always assume that no one can see you.

pact and probably reduced the motorcyclists' injuries.

Dr. Hurt suggests that motorcyclists should regularly reacquaint themselves with the braking ability of their cycles. This means hard-braking practice runs in a parking lot or on a deserted road. It's also a good opportunity to check out the mechanical condition of the brake system. An accident situation is *not* the time to find out that your brake cable has stretched beyond tolerance or that you are in need of new pads.

A lack of training

Most motorcyclists have never been properly trained in the operation of their bikes. They're taught by friends or relatives in the "there's the brake, here's the gas" school of motorcycling.

According to the Hurt study, properly trained motorcyclists were under-represented in the accident-involved group and the improperly trained were over-represented statistically.

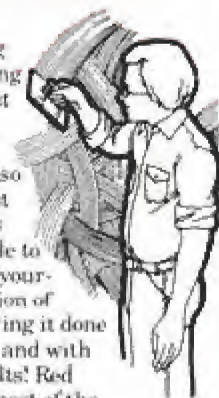
This means that, all things being equal, the professionally trained rider has fewer accidents than the one informally trained.

Where do you get training? Easy. Just write to the Motorcycle Safety Foundation, 780 Elkridge Landing

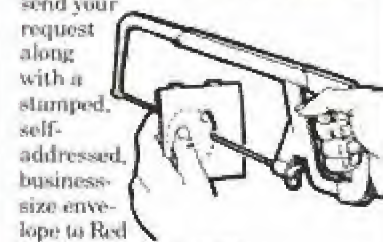
(Please turn to page 80)

HOW TO TILE

Ceramic tiling is fast becoming one of the most popular of all do-it-yourself projects. It's also one of the most rewarding. It's readily possible to do a tiling job yourself for a fraction of the cost of having it done professionally, and with excellent results! Red Devil makes most of the



products you'll need to install ceramic tile. And Red Devil shows you how to use them all in its free illustrated brochure "How To Install Ceramic Tile In Your Home." Get a copy at your Red Devil Dealer or send your request along with a stamped, self-addressed, business-size envelope to Red Devil, Inc., Box 155T, Union, NJ 07083.



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Remember when your vehicle's engine would actually respond when you stepped on the gas? Had enough power for safe passing or pulling heavy loads? Cruised without surging? Times have changed. Today's smaller engines run at lower rpm with less power.

Fortunately, there's a solution from Edelbrock, a company that's been producing top quality automotive products since 1938. A replacement intake manifold from Edelbrock will improve your engine's performance and driveability without sacrificing fuel economy. In fact, every Edelbrock street manifold features mileage potential in its design.

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For information on Edelbrock's complete line of intake manifolds, electronic water injection system and accessory items, send \$2 for our 48-page catalog to 411 Coral Circle, Dept. PM481, El Segundo, California 90245. Or visit your Edelbrock replacement manifold dealer, still listed in the Yellow Pages under "Racing and Sports Car Equipment." Our products are sold primarily through performance automotive parts dealers, as well as some traditional parts outlets.

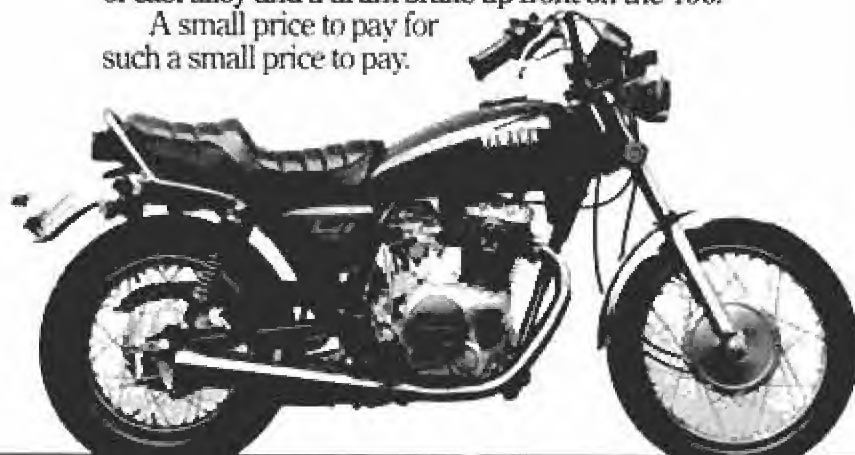
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Our XS400 and XS650 Special II's are specially priced for people who want the very most for the very least.

Just about all that separates them from our full-priced Specials is a little chrome, spoke wheels instead of cast alloy and a drum brake up front on the 400.

A small price to pay for such a small price to pay.



YAMAHA
THE WAY IT SHOULD BE.

Rear view mirror(s) standard equipment. Always wear a helmet and eye protection.

STAYING ALIVE ON TWO WHEELS

(Continued from page 79)

Rd., Linthicum, Md. 21090. This foundation holds motorcycle riding courses in every state. They include classroom instruction as well as training on your motorcycle.

Helmets

The Hurt study found that the average accident-involved motorcyclist receives 1.7 blows to the head. A full 22 percent of all injuries are head injuries. As a group, helmeted riders were under-represented in the study while unhelmeted riders were over-represented. This seems to indicate that riders who wear helmets are at least more safety-conscious than those who don't, and therefore are more cautious.

A good helmet can take a 1,000 gravity-force (G) impact and reduce it to 150 Gs. A 400-G impact will give a slight concussion.

The only helmet you should consider buying is one that meets one of the following safety standards: Snell Memorial Foundation, ANSI Z90.1a or DOT.

The strictest of these standards is the Snell standard. The Snell Foundation performs both destructive and nondestructive testing of helmets, and approves batches of helmets as they are produced. For instance, they do not approve an entire yearly production run simply on the basis of one test.

Most motorcyclists are taught . . . in the 'There's the brake, here's the gas' school of motorcycling.

Folk wisdom has it that there are only two types of motorcycle riders: those who have crashed and those who are about to crash. The implication here is that every time you swing a leg over your bike you've got an even chance of crashing. And if you don't get it on this trip, inevitably you're going to have an accident sometime in your riding career.

Statistically this isn't true. Not all bikers crash. Psychologically, however, riding with a crash attitude will probably keep you out of trouble.

PM

Save your head

For more information on safety helmets and their use contact:

American Motorcycle Assn., Box 141, Westerville, Ohio 43081

National Highway Traffic Safety Administration, 400 Seventh St. S.W., Room 5319, Washington, D.C. 20590

Safety Helmet Council of America, 9841 Airport Blvd., Suite 1208, Los Angeles, Calif. 90045

Snell Memorial Foundation Inc., 1876 Stockton Blvd., Sacramento, Calif. 95816

Thousands across nation using Ohio man's sure-fire way to get rich.

Are you an 8-hour-a-day working person? Do you have little or no savings in the bank? Are you in debt with mortgage, car payments and charge accounts? Do you have little experience at anything except the small specialty of your job?

If you've answered "yes" to all these questions, you are a prime candidate for a foolproof get rich system developed by a working man from Canton, Ohio. His name is Benjamin Swarez and he was in your exact same position not long ago. But, he changed all that by inventing a get rich system designed especially for the working man.

How did this system come about? You probably already know about Mr. Swarez and his system. Ads on his system and stories about Mr. Swarez have appeared in nearly every major newspaper and magazine in the country. Thousands of people across the nation have purchased the system and the stacks of letters from satisfied customers received by Mr. Swarez are overwhelming.

Mr. Swarez did not develop his system overnight. But his final, perfected version certainly does generate income overnight.

Mr. Swarez's first successful system netted him \$80,000 clear. What's it like to get \$80,000 almost overnight in one lump sum?

It's almost impossible to verbalize. My wife and I just stared at the check for a long time. We had a two-day celebration with a dinner and party. Then I went into work and told my smug boss, who thought he had me under his thumb, what he could do with his low paying lousy job. Next we paid off all our bills including our house mortgage and had a burn-the-mortgage party.

The following day we went to an auto dealer's showroom and laid down cash for a new luxury car. I never had the experience of a new car even as a child.

Then my wife and I went on a shopping spree for clothes. We had been making do with old clothes for so long they had become worn out. She always had to shop for clothes with very little money. I always joked with her that "If I gave you \$5,000 to spend on clothes could you do it in one day?" She used to say, "I could do it in a couple hours." So that's what I did. I gave her \$5,000 to go out and buy clothes. It ended up taking all day and she said she relished every minute.

Finally, we took a long trip. In New York I bought her a large diamond at Tiffany's--another thing we always dreamed about.

But I can tell you that the money was not the most important benefit in this. What money really does is give you precious time. Time to be with your wife and children before they grow up before you know it--and time to do things you really want to do. Another priceless thing you gain is your self respect. No more crawling and kneeling because you're dependent. The words of Frank Sinatra's song "My Way" say it all."



Benjamin Swarez

How much money can you make and how fast can you make it?

Mr. Swarez averages around \$200,000 for each system he produces. He says doing a system to make \$10,000 or \$20,000 is literally duck soup. "I have these available to me all the time and don't

even use them," he says.

How fast can you make money? Mr. Swarez stated, "You can actually make money within hours in some cases. You can compile a system in one afternoon one day and start having spendable money in your hands produced by the system the very next morning."

Who can do it and how sure fire is it? Mr. Swarez says, "I've done it 14 times in a row now. I taught my younger brother and brother-in-law the system and they've already made over \$500,000 each. All you need is the ability to follow simple directions, common sense, and the ability to see a job through to completion."

This system is also perfect for people who are confined to homes, such as housewives. Mr. Swarez named his system **SuperBiz**. He has been selling his system to others for a year now. The reason? "Why not?" he says. "First I thought I'd have to keep it secret. But then I found out the system can't be saturated, so why not sell it and make money by selling the system on top of the other money I am making using it."

People from every state in the union have purchased Mr. Swarez's system. What do these people have to say? Here are just a few comments:

"...It is such an excellent product that anyone who can read and follow instructions can be a millionaire..."—W.J.B., Peoria, IL.

"...This is the first time I have purchased a 'get rich' product that I sincerely feel will work..."—E.J.D., Chicago, IL.

"...Adjectives alone cannot describe its hidden wealth. After many years, much money and a bellyfull of frustration, I believe I have found an honest man, and yes, I truly mean it..."—J.T.V., Norridge-wock, ME.

"...I have just received your system and have taken it to college. It has really lifted some eyebrows especially the first and last parts..."—M.K., Rockhill, SC.

A word to the doubting Thomases. Of course there will be those who will doubt that the system is for real. Mr. Swarez has featured this system in nearly every newspaper in the country and he has sold his system to thousands of people across the nation and in every state of the union. The story has been checked repeatedly by newspaper reporters and government authorities at literally every level. The story checks out. Every word he has stated about his system is true or he would've been out of business long ago.

You can make \$100,000 in a matter of weeks or days. In some cases money starts in hours. Here's how it works...

1 You will receive Mr. Swarez's system in the mail which contains everything you need to complete one of your own systems. From anywhere, such as your kitchen table, you complete the preliminary steps. This involves filling out provided forms and following provided outlines.

2 The preliminary steps of the system are done only one time. After these preliminary steps, you can do the steps for each individual system anywhere, from your home, while you are traveling. (Mr. Swarez does his individual systems in his motorhome) or from a favorite vacation spot. Again, by following outlines and filling out forms, you complete your individual system (each of which is in two parts, Part A and Part B).

3 After completing Part A and Part B of the System, depending on the type of system you do, you may either phone in Parts A and B of your individual system, or you drop it in the mail. In the type of systems where you phone in Parts A and B, you can virtually complete a system one afternoon and have spendable money in your hands the very next morning.

4 In a matter of days or weeks, depending upon which system you do, you can receive \$100,000 for each system you do. In some cases, over 80% of the money will be in your possession in less than a week. Your money will either be deposited in your bank account or brought to you by mail to your home or your vacation spot.

For those who wish to purchase the N.P.G.S. System called **SuperBiz**, it is being distributed by mail only for the present. Mr. Swarez has kept the price of the system low so those who most need it can afford it.

To order (1) Get a blank piece of paper; (2) At the top print the word **SuperBiz**; (3) Print your name and address; (4) Mail this along with \$20.00 in cash, check or money order to Quality Consumer; Dept. 1-174, 706 Twelfth St. N.W., Canton, Ohio 44703.

Or, if you want us to start processing your order immediately, phone in your order as follows: (1) Dial this TOLL FREE number, 1-800-321-0888 (Ohio residents dial 1-800-362-0636) and ask for Operator

(2) Say the word **SuperBiz**. (3) Give your name and address. (4) Give the operator one of your following credit card numbers: Master Charge or Visa (also include your Interbank number). Or, if you don't want to use a credit card, tell the operator you want it mailed C.O.D. Operators are on duty right now and around the clock.

Direct any inquiries to (216) 452-0868. Please do not dial the toll free number for information. The operators are not permitted or qualified to answer questions.

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SCIENCE WORLDWIDE

The fall of Anshan

American archeologist William Sumner is combing through the ruins of the ancient Persian city of Anshan to find clues as to why the once-thriving urban center fell into de-



Sumner (kneeling) sifts earth at Anshan.

cay. One of Sumner's goals is to discover lessons that may help us protect today's cities from blight.

In digs, spanning five summers, Sumner has extracted more than 10,000 artifacts from a huge mound of earth. He found remains of scores of buildings dating from 3400 to 1000 B.C., when the city, located in what is now southwestern Iran, had decayed to little more than an outpost for a few stragglers.

Why the decline? Some theorists suggest that Anshan and other Mes-

opotamian cities were ravaged by a series of wars. But Sumner disagrees. His best guess is that over the course of centuries, Anshan residents had to spend more and more of their time traveling away from the city to find wood. They used the wood for cooking, brickmaking and smelting; a single smelting furnace alone may have gobbled up two tons of wood a day. As nearby forests were depleted, the cost of wood rose. Sumner concludes: "We just might find that it was a fuel crisis that precipitated the fall of Anshan—and perhaps other civilizations as well."

Simulating Earth's crust

Stanford researchers call it "the Bomb Lab" because the containers used in experiments resemble explosive devices. But these "bombs" are actually used for creation. They contain enough pressure and heat to simulate conditions deep in the Earth's crust, where basic chemicals are "cooked" into minerals.

Gordon E. Brown, associate professor of geology, and his colleagues are trying to match conditions underground with temperatures up to 1,300° C. and pressures 150,000 times greater than the air pressure at the surface. Goal of the research: "In a world which, before long, will be crying out for more metals and minerals, we are still at the beginning of our knowledge about how they are formed and where to look for them," Brown says.

The golf-ball infection

Ohio State University researchers have been implanting plastic golf balls into test animals to help test the safety of new vaccines.

The hollow golf balls, riddled with holes, fill with fluid after they are placed under the skin of sheep. Although no bacteria are present—the golf balls are sterilized before the implant operation—the bulging site has many characteristics of a local infection.

After the operation, researchers, including Clyde Smith, professor of veterinary medicine, inject a live vaccine, a weakened form of a disease-causing organism, into another part of the sheep's body. The challenge in developing new vaccines is to make them strong enough to stimulate the body into producing natural defenses, but weak enough not to cause serious disease. Among other tests, federal regulations require researchers to show that vaccines will not move from the injection site to an inflamed area.

By extracting some of the fluid

(Please turn to page 85)



Aerial view: dig at ancient Persian city.

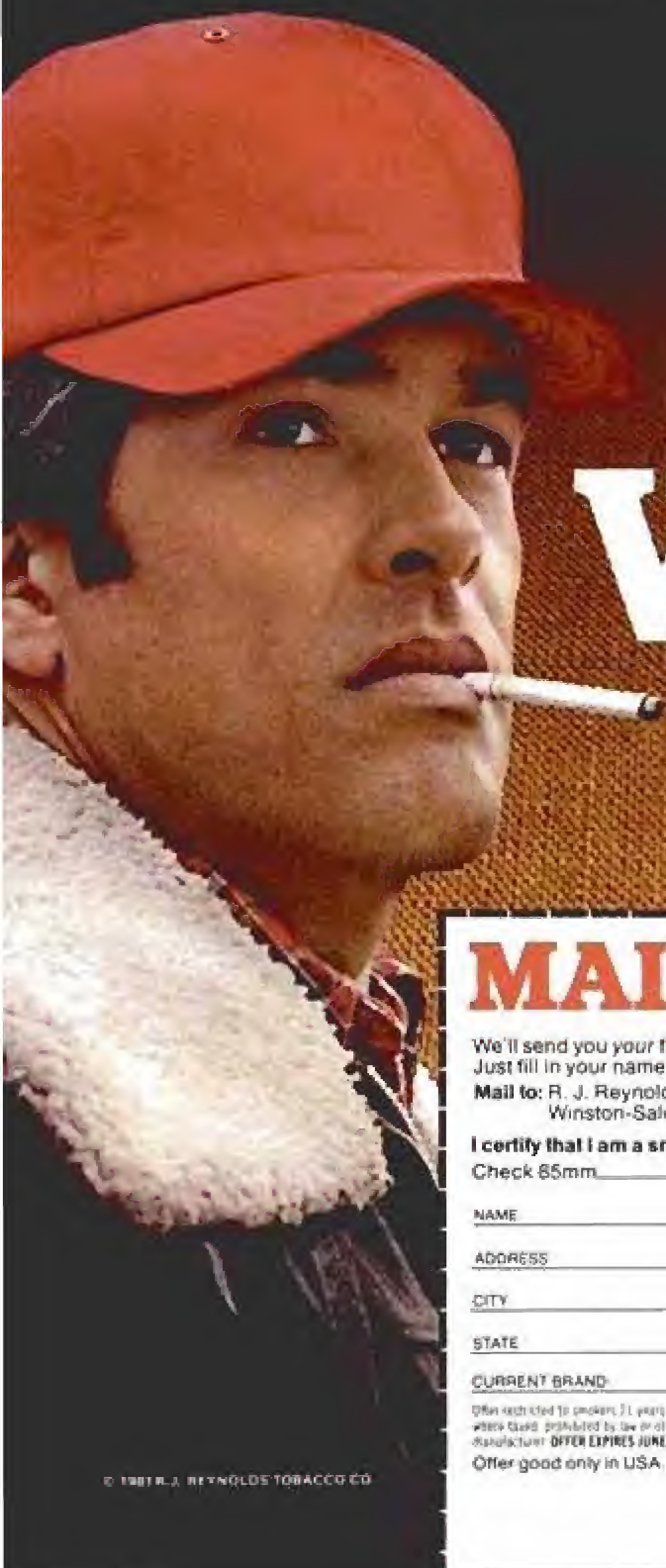
opotamian cities were ravaged by a series of wars. But Sumner disagrees. His best guess is that over the course of centuries, Anshan residents had to spend more and more

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SCIENCE WORLDWIDE

(Continued from page 52)



Golf ball (inset). Implanted in sheep, acts as an infection site in new-vaccine tests.

from the golf ball after an animal has been vaccinated, the Ohio scientists can test whether the vaccine has migrated. If the golf-ball fluid is "clean," then the vaccine "probably won't move to the lungs where it could cause possible disease," Smith says.

Space veteran

In the mid-1960s, officials at the National Aeronautics and Space Administration were hopeful that the Pioneer 6 interplanetary spacecraft would circle the sun for about six months.

Recently, Pioneer 6 completed its 15th year of operation—longest working life of any interplanetary probe.

In the course of its 9 billion miles of traveling, the 140-pound Pioneer has sent about 4 billion bits of data to Earth. It has transmitted news of solar storms from the sun's invisible side, measurements of a comet's tail and portraits of the sun's corona. "Pioneer 6 is such a good spacecraft," says Mission Manager Richard Fimmel, "that we may get another 10 years out of it." **PM**

BY GURNEY WILLIAMS III



Start your own money making business!



Get in on the PROFITS in SMALL ENGINE service and repair



BEAT INFLATION! Work part time, full time right at home— we help you every step of the way.

In just a short time, you can be ready to join one of the fastest growing industries in America...an industry where qualified men are making from \$10.00 to \$15.00 per hour...and that's just for labor. Parts, engines and accessories add even more to the profits. Because the small engine

industry has grown so quickly, an acute shortage of qualified Small Engine Professionals exists throughout the country. When you see how many small engines are in use today, it's easy to understand why qualified men command such high prices—as much as \$17.50 for a simple tune-up that takes less than an hour.

46-million small engines are in service today!

That's right—there are over forty-six million 2-cycle and 4-cycle small engines in service across the U.S.A. That's the official count from the Engine Service Assn., and new engines are being built at a rate of one-million per month! With fully accredited and approved Belsaw training, you can soon have the skill and knowledge to make top money servicing these engines. Homeowners and businessmen will seek you out and pay you well to service and repair their lawnmowers, tillers, edgers, power rakes, garden tractors, chain saws, minibikes, go-carts, snowmobiles...the list is almost endless.

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You don't need to be a 'born mechanic' or have prior experience. If you can read, you can master this profitable trade right at home, in your sparetime, without missing a single paycheck. Lessons are fully illustrated—so clear you can't go wrong.

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"I've had about 8 years experience repairing small engines...but repairs were only minor...until I started the Belsaw Course."

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ACCORDING **TO THOSE WHO KNOW** **PICKUPS BEST,** **VW IS THE YEAR'S** **BEST PICKUP.**

The people at Pickup, Van & 4WD maga-

zine just chose

the VW diesel as their 1980

"Pickup of the Year."

Which is a great

honor. But no great surprise.

Because there

was no other pickup that could match up to it. And our 1981 is even better.

Take handling: Thanks to its precise rack-and-pinion steering and front-wheel drive, the VW Pickup actually handles more like a sportscar than a truck. (What's more, it has enough pickup to out-accelerate an MGB.)

Yet it still gives you a full six-foot-long bed that's big enough and tough enough to handle up to 1100 lbs. of solid payload.

In addition, no other truck in its class offers you the solidness of

double-wall construction and a fully unitized body.

And, perhaps most important of all, no other truck in America offers you better mileage.

In fact, with its optional diesel engine and 5-speed transmission, the VW Pickup gets an estimated [38] mpg, 51 est. highway. (Use "estimated mpg" for comparison. Your mileage may vary with speed, weather and trip length. Actual highway mileage will probably be less.)

All of which has really made a hit with the people who know pickups best.

The ones who buy them.

VOLKSWAGEN **DOES IT** **AGAIN**



IMPORTS & MOTORSPORTS

Pacing Indy



A customized Buick Regal is pace car for '81 Indy 500.

When the pace car at this year's Indy 500 accelerates out of the fourth turn pushing 110 mph, with 33 howling race cars in pursuit, it's got to dive for pit lane and get out of the way—fast. So, you know that the Buick Regal that'll be running out there is not exactly a car right out of the showroom. It's been reworked dramatically and it's a gem. The standard, 3.8-liter V6 has been replaced by Buick's 4.1 V6, which has a compression ratio boosted to 12.5:1. And what started as a Regal coupe with hatch roof is now a trussed-up convertible: The support between the hatches joins the windshield with an eight-inch-wide roll bar (same arrangement as the Triumph Stag; remember that one?). Behind the roll bar is a folding convertible top. Front seats are leather Recaros, putting the final touches on one sweet setup.

The 65th running of the Indianapolis 500 is set for Sunday, May 24, and in PM's May issue we'll have a story on America's greatest sporting event, including information on the stock blocks-only rule for '82.

Sport-wagon trend

"Stunned" is the only way to describe my reaction to the first high-speed corners and bends I took with Volvo's 1981 GLT wagon: I was all ready to opposite-lock the steering wheel to bring the rear end back in

line, but it never went anywhere. In 1000 miles of driving I was astounded over and over again at the sports-car handling of what I consider a trend-setter wagon—the first of more sporty wagons we'll see in the near future. (Not a real sport wagon yet, but the hot domestic setup, especially if you've seen it in red, is the Escort/Lynx wagon.)

The GLT wagon uses the same suspension as the GLT and Turbo



Sport-wagon potential: the Ford Escort.

sedans, and the same bullet-proof B21F Four. I managed 20 mpg overall during my pokey city driving and forays for mph on smooth, wide-open Interstates. The anniversary edition (25 years of Volvo in America) could be mistaken for a one-off show car: Silver metallic paint, five-spoke alloy wheels, wide Pirellis, front spoiler and black-out trim are a pleasure to look at. And the blue velour and comfort inside will stun the family member who's not as enthusiastic about a station wagon's ability to follow a Ferrari on a twitchy back-country road.



Volvo GLT: Style and handling built into sporty station wagons would be a nice trend.

Volvo's last sport wagon, based on the P1800 sports car, just didn't offer the room that sedan-based wagons do, so had limited appeal. The GLT, however, is truly a family wagon: It's got looks, performance, comfort and lots of room. Keep dogs and sleds in the back, please.

Economy limo

Yes, it is a Honda Accord—plus 42 inches welded in the middle. It had to happen: fuel efficiency and front-wheel drive wedded to luxury and roominess for the company execu-



Fuel-stretching limo is a stretched Honda.

tive with a conscience. He gets 30 mpg and a 13-inch color TV in this custom alteration from Jim Ellena Honda in St. Charles, Mo. There's a lot more in the way of amenities—telephone, bar and so on—for the \$29,500 price tag.

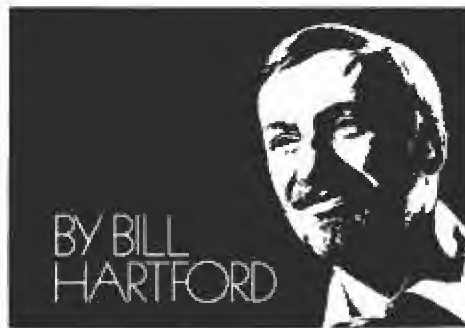
Car quiz

Does anyone need the answer to last month's car quiz (*Imports & Motorsports*, page 79)? That wheel is clearly the shape of the triangular rotors that spin within the epitrochoidal housing of a rotary engine. The car, then, can be none other than the Mazda RX-7, the only rotary-engine car sold in America. And the wheel is detailed right down to the apex seals on each rotor. (For our update on the rotary and an Owners Report on the RX-7, see PM, Oct. '80, pages 83 and 86.) Want to try another car? See headlights above. Sorry, no hints this time.



What car has these unique headlights?

PM



BY BILL HARTFORD

ATTENTION:

Router Owners (And Would-Be Router Owners)

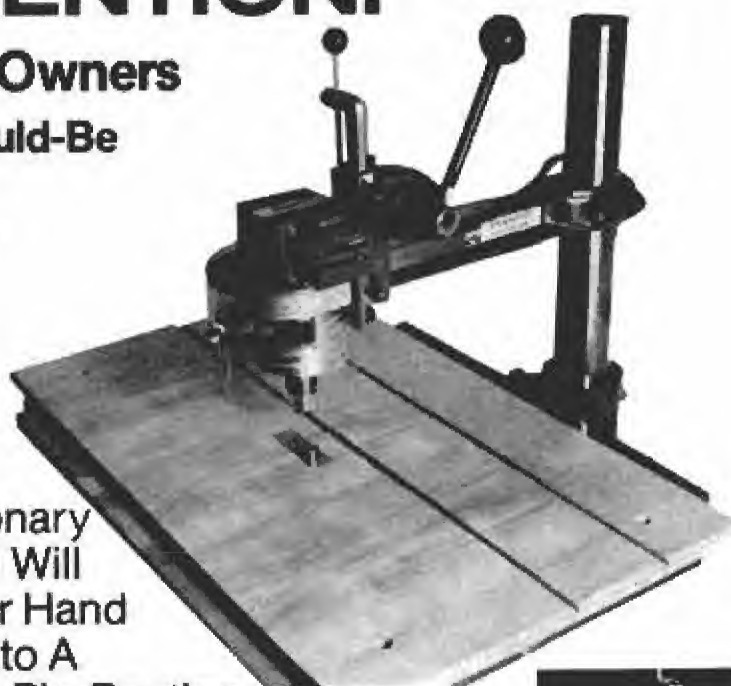
This Revolutionary New Tool Will Turn Your Hand Router Into A Precision Pin-Routing System!

Enjoy the same woodworking capabilities once reserved for furniture factories and cabinet shops — at a fraction of the price!

Based on the same principle as commercial pin-routers costing \$2000 to \$5000 — the Shopsmith Router Arm is a quality tool that will make your woodworking more efficient and enjoyable!

It will give your router the type of accuracy that always assures you of professional results. And in every case it will make the difference between projects that look homemade and projects that look professionally custom-made.

Easy to operate, this precision tool transforms your hand-held router into a full-capacity production machine and simplifies a number of operations. It's the ideal tool for duplicating — but that's just the beginning. You can also perform many other jobs! Use it for...



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Decorative Edging



Freehand Routing



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Engines used for stop and go trips, or run for less than half an hour at a time, form crankcase sludge! Sludge plugs oil filters and oil passages. It can block the oil pump screen so that working parts may starve for oil!

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When the worst drought in 44 years hit Oklahoma, an old well driller found a new way to cash in on. . .

BACKYARD WATER WELLS

BILL HARRINGTON

I've been drilling water wells in Oklahoma for about 15 years.

When I first saw the ad that claims a man can drill his own water well with a Hydra-Drill, I was extremely skeptical. I thought to myself — how can that be? That's impossible. It takes a big engine, it takes a big rig to drill a water well. But my curiosity kept nagging me, so I sent off for the information.

My daughter's boyfriend is a well driller over in Arizona. I showed him the Hydra-Drill literature. His first reaction was "I don't believe it. I don't believe a 3 hp. drill can do the same thing my 100 hp. drill does." But the more I studied it, the more it sounded like a good idea.

A WATER SHORTAGE

Another thing on my mind was the drought. We're having the worst drought here since the dustbowl days back in the '30s. A lot of towns around here all the way over to Tulsa are running short of water, and some of them have started water rationing. It's very hard on a lot of people, but business is good for well drillers. I'd been thinking about buying another drill and putting my son Robert in business. He's 18 years old, and he'd never worked on a drill before. I decided he could learn with a Hydra-Drill.

EASY SET UP

Now when I started out in the drilling business 15 years ago, I had a big drill that just about worked me to death. Later, I got a rotary drill. It was easier to operate, but it took a day and a half to set up and drill a well in this area. You can't imagine how I felt when they delivered our Hydra-Drill. It was so compact, very simple. Robert and a young friend of his took it out and set it up in just a few minutes.

OUR FIRST HYDRA-DRILL WELL

The day we went out to drill our first well with the Hydra-Drill, I was all fixed to work with the boys and give them plenty of advice. However, it was a very hot day — about 100 degrees — and once they got started drilling I could see they didn't need me standing right there, so I went over and sat down in the shade of a tree. In about an hour, they came over and I asked them if they were taking a break, and they said no, they had just finished drilling the well.

It was amazing. They had drilled down forty-seven and a half feet and hit a layer of beautiful, coarse sand — the kind that produces good water and a lot of it. They had drilled that well in less time than it takes me just to set up my big drill.



PHOTO BY TONY JACOBY

Later, I figured they had drilled that well with less than one gallon of gas. My big drill would burn up at least fifteen gallons of gas for that job!

MAKES MONEY

The next day we drilled a well 115 feet deep through rock, and it went fast too. The Hydra-Drill really takes the hard work out of it. It's fast and economical, and that's what it takes to make money drilling wells.

Also the Hydra-Drill is so portable we can set up and drill anywhere. In the past, I've lost out on some jobs because people were afraid my big drill would tear up their yard. With the Hydra-Drill, we can drill without tearing up anything or making a mess. This is a big selling point to my customers.

I'm just grateful to have this Hydra-Drill. I've got my son started in a good business he can make some money with. If I had bought another big drill, it would cost thousands of dollars, and that is just ridiculous because the Hydra-Drill does the job just as good. In fact, I figure we earned enough to pay for the Hydra-Drill the first week. From here on, we're in the blue chips.

GOOD, PURE WATER

I believe anyone can drill a well with a Hydra-Drill. Even if they just wanted to drill their own well, they'd save money. It's simple and it's easy if they just read the instructions. And the best part about it is that you get good, pure water without all those chemicals in it, and the water costs you, say 5 cents for a thousand gallons. You certainly can't buy city water for that. And it's a great feeling to have all the water you want even when

the city is rationing water to everyone else.

The man who invented the Hydra-Drill really knew what he was doing. Modern technology is a wonderful thing, isn't it?

NOTE: Popular Mechanics readers can get a big, fully illustrated information kit on the Hydra-Drill including a booklet, "How to Drill Your Own Well." The information kit is available free, without obligation. Requests should be addressed to DeepRock Mfg. Co., 5344 Anderson Rd., Opelika, AL 36802.

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For less than \$1 per ft. you can drill a water well in your backyard next weekend!

Have all the pure, fresh water you want FREE! The HYDRA-DRILL drills water wells 50 to 200 feet deep. Easy to operate as a power lawn mower!



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London University "Crash-Loss" Wonder Diet...

Burns Away More Body Fat Each Day Than 15 Hours Of Non-Stop Exercise!

Shrinks Down Your Waistline As Much As A FULL SIZE SMALLER IN JUST 24 HOURS... 4 SIZES SMALLER IN JUST 14 DAYS!

YOU ACTUALLY SHRINK YOUR BODY'S FAT CELLS STARTING IN JUST HOURS!

What you see on this page is news of a fantastic crash-loss program—the remarkable London University super slim-down diet—that speeds up your body's rate of fat burn-off so that, IN JUST A MATTER OF HOURS, you start to burn away clinging layers of fat ... break down bulging pockets of flab ... drain away excess puffy fluid, just like hot water melts down ice ... so that, in just the first 48 hours, excess flab, fluid and fat gets melted away at such a staggering rate of speed you:

**LOSE up to 1 lb. EVERY 5 to 12 HOURS
LOSE up to 1½ to 2 lbs. EACH DAY!**

Yes, lose weight by the hour, carve away inches by the week and as stated above, we feel compelled to repeat ... shrink down as much as 4 sizes smaller IN JUST 14 DAYS!

GOVERNMENT OFFICIAL LOSES 10 POUNDS IN JUST 72 HOURS—

So effectively does this London University's wonder "crash-loss" diet step up your system's rate of fat burn-off, that:

■ When tested at one of medical science's foremost research centers on scores of grossly overweight men and women ... they lost as much as 7 lbs. of excess fat, flab and fluid IN JUST THE FIRST 72 HOURS ALONE ... and as much as another 3-5—even 7 POUNDS MORE the next 14 days!

■ Even more amazing ... when tested not on ordinary overweight people but on the most extreme cases of obesity ... it EVAPORATED up to 10 POUNDS OF FAT, FLUID AND FLAB IN JUST 3 DAYS TIME!

AS MUCH AS 50% OF ALL EXCESS WEIGHT GONE IN JUST 14 DAYS!

■ But most mind boggling of all ... when tested on average overweight people ... who for years lugged around a "spare tire" bulge of 10, 15 or even 20 extra sagging pounds ... IT ACTUALLY MELTED AWAY AS MUCH AS 50% OF ALL EXCESS WEIGHT IN JUST 14 DAYS!

Yes, stepped up their body's rate of fat burn-off and melted away hard set fat with OVER 20 TIMES THE SPEED OF EVEN BRUTAL EXERCISE!

TURNS YOUR ENTIRE BODY INTO A SUPER FAT-BURNING FURNACE!

In fact, based upon Calorie Burn-Off Research From California's Leading Medical School, the calorie-deficit created in your system by this "crash-loss" high-burn program, (a staggering deficit of as much as 2,400 calories a day off required daily intake) works with such breathtaking speed you actually:

BURN AWAY MORE FAT EACH DAY THAN

- Running 100 Miles A Week
- or—over 3,000 sit-ups and push-ups a day
- or—10 Solid Hours of Weight-lift workouts
- or—even 15 hours of non-stop Marine Corps calisthenics!

WAKE UP SLIMMER THE VERY FIRST MORNING!

What is this amazing fat-destroyer wonder program that helps to burn away fat by the hour, carve away inches by the week?

Briefly stated ... it is London University's crash-

burn diet, a remarkably simply way to take special combinations of high-burn foods and create what doctors call a "hypocaloric effect" to take place inside their bodies ... that turns their system into a GIANT FAT BURNING MACHINE! Yes, actually reverses your body's fat build-up process as you COMPLETELY STOP EXCESS fat-builder calories from entering your system ... or being absorbed by your body and turned into fat like in the past! So obviously, down go the calories, up goes the rate of fat burn-off and off come the pounds and inches at a rate that absolutely staggers the imagination!

Yes, a TOTAL FAT-DESTROYER program that literally "ignites" a fat-burning chain-reaction inside your system ...

"revs up" your body's rate of fat burn-off ... and ACTUALLY SHRINKS YOUR BODY'S FAT CELLS starting in just hours.

Think of it! With each tick of the clock, your body burns away a steady flow of fat-builder calories ... melts down even the most stubborn fatty bulges ... so you lose weight like never before ... LOSE IT BY THE HOUR ... all starting the very first day. In fact, of all medically sound reducing programs, ONLY TOTAL STARVATION WORKS FASTER!

Because, quite obviously ... since this London University ALL OUT ASSAULT ON FAT lowers your system's rate of calorie intake ... raises the level of calorie burn-off ... "revs-up" that rate of body-fat burn-off ... pounds and inches vanish at a rate that in plain simple talk is ABSOLUTELY MIND BLOWING!

World's Leading Medical Authority on Obesity Reports:

'...as much as 50% of all excess fat gone in just 14 days.'

AMAZING "FURNACE-IN-A-CAPSULE" HELPS TRIGGER THE MOST DYNAMITE FAT-BURN SPOOF OF YOUR LIFE!

Now comes the most exciting news of all. Because, now from London, England comes the thrilling announcement and release to the American public of a wondrous reducing-aid formula that not only works before meals to reduce hunger, but after meals supplements this London University "crash-loss" diet and helps you keep the fat-burning chain-reaction going in your body non-stop all day long.

Called "BIO-THENE/100," these amazing time-release capsules work in your body from morning 'til night to help you lose weight with a 2-stage all-out attack.

STAGE 1: Turns off your hunger drive ... that maddening urge to eat, just like you turn off a light switch. Makes it easier to lower calorie intake.

STAGE 2: Throughout the day, releases into your system tiny grains of a special bio-extract that safely, surely, TURNS UP the level of your fat-burning metabolism after every time food enters your body on this London University wonder diet program.

Meaning, the food you take in, the calories you enjoy are burned away even more quickly by your own stepped-up metabolic system. Yes, metabolized and oxidized in as little as 2 to 3 hours after eating!

THE FOOD YOU EAT NO LONGER TURNS TO FAT!

So, obviously, since it takes far less food to satisfy you, lowering calories is a lark. And since the calories you do take in on this "crash-loss" diet program are burned right out of your body after every time you eat ... you start to TURN SLIMMER, not only the very first day ... BUT—after the very first meal—and every meal thereafter! as excess fat and fluid start to disappear—GET OXIDIZED BY THE HOUR!

In fact, of all medically sound reducing programs
ONLY TOTAL STARVATION WORKS FASTER!



PROVE EVERY LOST OUNCE.

EVERY LOST INCH—ENTIRELY AT OUR RISK

Right now, look at your figure in the mirror and ask yourself these questions—the solution to which is right now within your grasp.

How would I look one week from today as much as 5 to 10 pounds lighter?

How would I look in 2 weeks with my waistline 2 to 4 sizes smaller?

BUT DON'T STOP THERE—if you need to lose still more inches, then continue the London University "crash-loss" diet, continue to take BIO-THENE/100 until you've reached the figure of your dreams:

- 6 INCHES CARVED OFF YOUR HIPS ... UP TO ANOTHER 3 INCHES CARVED OFF YOUR THIGHS ... ANOTHER 4 INCHES OFF YOUR BUTTOCKS ... ANOTHER 6 INCHES OFF YOUR STOMACH ... ANOTHER 6 INCHES OFF YOUR WAISTLINE!

Because NEXT TO COMPLETE STARVATION THERE IS SIMPLY NO OTHER MEDICALLY SOUND REDUCING PROGRAM THAT WORKS FASTER.

—MAIL NO RISK COUPON—

BIO-THENE/100, Dept. LBNM—5
Station Plaza East
Great Neck, N.Y. 11021

Yes, I want to lose more weight each day than 15 hours of non-stop exercise. Please RUSH me the BIO-THENE/100 "Crash-Loss" program as indicated below. I must lose pounds and inches as never before or my money refunded in full (less postage and handling).

CHECK OFFER DESIRED:

- ☐ (#015) 15 Day Supply only \$6.95 (plus 50¢ postage and handling)
- ☐ (#020) 20 Day Supply only \$9.95 (plus 75¢ postage and handling)
- ☐ (#030) 30 Day Supply only \$12.95 (plus \$1 postage and handling)
- ☐ (#060) 60 Day Supply only \$20 (We pay all postage and handling)
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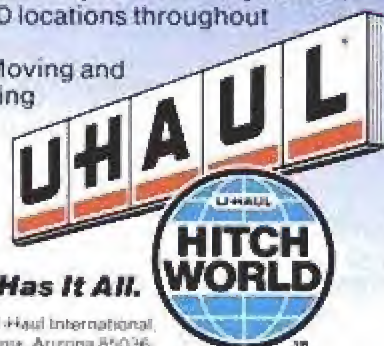
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SPACE SHUTTLE: 9 CRITICAL COMPONENTS THAT MUST NOT FAIL

Long before the space-plane came close to a launch pad, NASA drew up a list of decisive parts.

by Gurney Williams III
SCIENCE EDITOR



Nine systems critical to the success of the shuttle are illustrated on the next two pages; the two subsequent pages look back at other dramatic NASA missions.



NASA's Robert Crippen (left) and John Young, chosen as first shuttle riders.

It may seem like old times: the spacecraft climbing slowly on five columns of fire, the noise so loud (160 decibels) it comes through TV speakers sounding like the ripping of cloth, the dry voice of mission control, the moist eyes of tourists on Cocoa Beach.

But if the National Aeronautics and Space Administration (NASA) can pull off the shuttle launch—first U.S. manned space flight since July 1975—it won't be like old times.

Count some of the differences: The two men in the Columbia cockpit won't be wearing space suits. Instead, like space travelers in early science fiction accounts of interplanetary (The text continues on page 209)

NASA's hopes rest on high technology

COMPUTERS

Five identical on-board computers are essential for navigation and control of the shuttle. Array is far more powerful than data-processing gear aboard any previous spacecraft, with three times the memory capacity and 40 times faster processing than computers aboard Saturn V vehicles. A concern: Computers must be cooled adequately to work.

DOOR HARDWARE

Payload bay doors must open in space to expose heat-dissipating radiators. And 32 latches must be closed before reentry to prevent heat buildup in bay, which could threaten the structural integrity of the orbiter's midsection.

TILES

Much-publicized tiles protect aluminum skin from 1000° Celsius (1832° F.) temperatures during reentry. But tiles are at greatest risk during liftoff and as spacecraft approaches Mach 1 at around 30,000 feet, about a minute after leaving pad. Major concerns: buffeting noise (about 160 decibels) at liftoff and mechanical stress near sound barrier.

COOLING SYSTEMS

Radiators (which in an actual mission would not be exposed until engines are shut down) consist of rows of aluminum pipe, with a total length of close to a mile. Liquid Freon flowing through pipe transports heat from avionics and crew for release into space. Flash evaporators, behind cargo bay, also dispose of dangerous heat by using it to boil water. The resulting steam is then vented overboard.

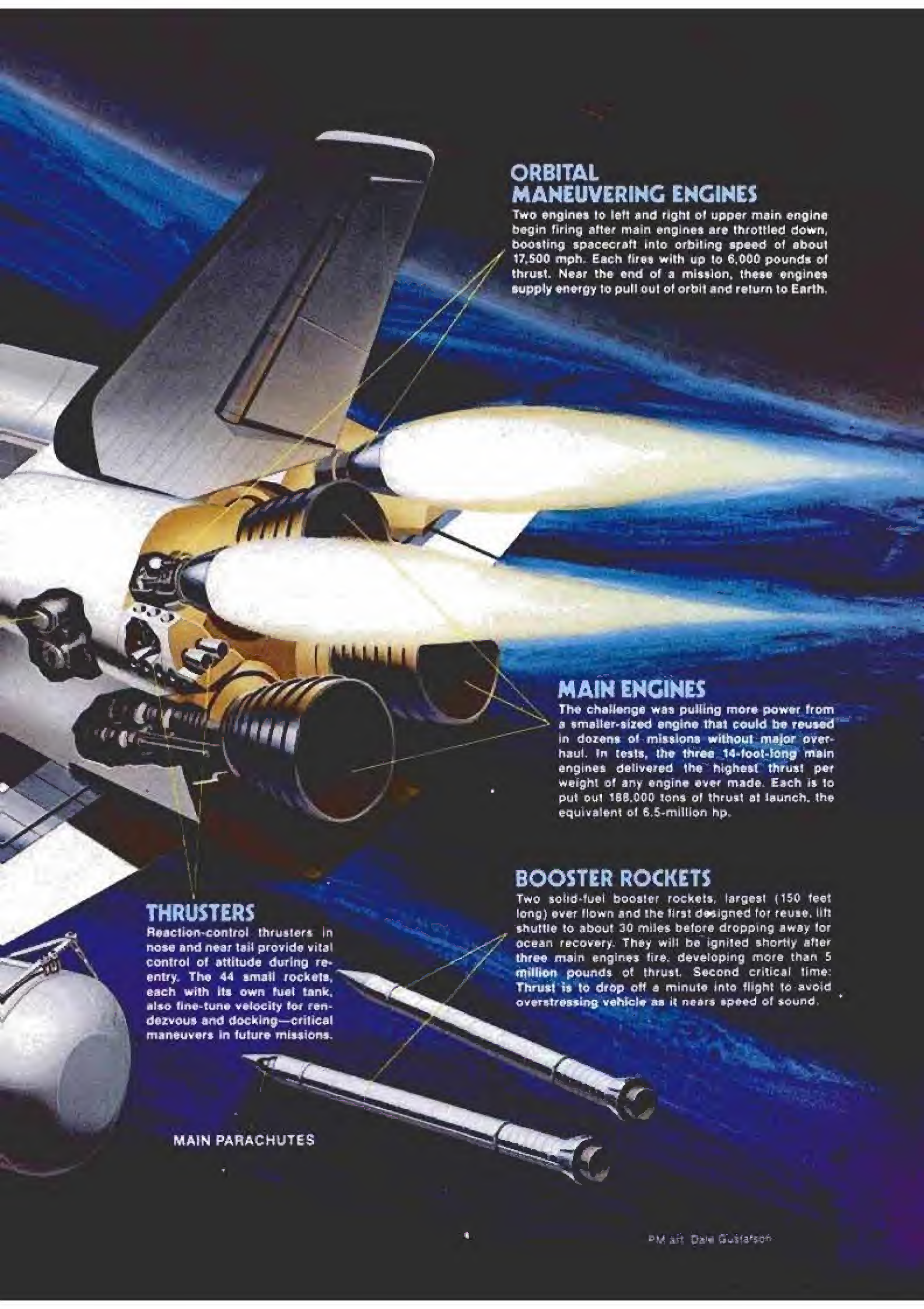
EXTERNAL TANK

Expendable, comparatively inexpensive fuel tank holds entire shuttle structure together at launch. One critical feature: Cork/epoxy coating and spray-on foam insulate cold fuel containers from outside air, preventing a buildup of ice that could endanger the orbiter if the ice breaks off in chunks at liftoff.

LIQUID OXYGEN

LIQUID HYDROGEN

Shuttle engineers pinpointed key systems for PM. The risk and challenge: Much of the vital hardware has never flown in space before.



ORBITAL MANEUVERING ENGINES

Two engines to left and right of upper main engine begin firing after main engines are throttled down, boosting spacecraft into orbiting speed of about 17,500 mph. Each fires with up to 6,000 pounds of thrust. Near the end of a mission, these engines supply energy to pull out of orbit and return to Earth.

MAIN ENGINES

The challenge was pulling more power from a smaller-sized engine that could be reused in dozens of missions without major overhaul. In tests, the three 14-foot-long main engines delivered the highest thrust per weight of any engine ever made. Each is to put out 168,000 tons of thrust at launch, the equivalent of 6.5-million hp.

BOOSTER ROCKETS

Two solid-fuel booster rockets, largest (150 feet long) ever flown and the first designed for reuse, lift shuttle to about 30 miles before dropping away for ocean recovery. They will be ignited shortly after three main engines fire, developing more than 5 million pounds of thrust. Second critical time: Thrust is to drop off a minute into flight to avoid overstressing vehicle as it nears speed of sound.

THRUSTERS

Reaction-control thrusters in nose and rear tail provide vital control of attitude during re-entry. The 44 small rockets, each with its own fuel tank, also fine-tune velocity for rendezvous and docking—critical maneuvers in future missions.

MAIN PARACHUTES

A generation of manned space

MERCURY REDSTONE 3 May 5, 1961

The orbital flight of Russian Yuri Gagarin on April 12 helped assure nervous U.S. scientists that man could survive weightlessness. But some senators argued the planned quarter-hour suborbital Mercury flight should be conducted in secret in case it failed. And President John F. Kennedy kept calling NASA for further reassurances of safety almost until launch. Navy Cmdr. Alan B. Shepard went through almost a minute of buffeting after liftoff, then entered weightlessness without realizing it. "Just a pleasant ride," he said after dropping into the sea.

GEMINI 4 June 3-7, 1965

Astronaut Edward H. White floated out of the cramped two-man capsule and into space over Hawaii during the third revolution around the Earth. "I was reluctant to come in," White said later. His 23 minutes on the end of a tether disproved contentions that men would experience an overwhelming dizziness outside of their spacecraft. But the flight was not without a hitch: A computer failure required White and James A. McDivitt to take over manual control during the landing, and the capsule dropped about 50 miles short of its target.

APOLLO 11 July 16-24, 1969

In dazzling sunshine, at 10:56 p.m. EDT on July 20, astronaut Neil A. Armstrong pulled a "D" ring to aim a TV camera at the gray lunar surface. Then he stepped into the picture—onto the moon. He and Edwin "Buzz" Aldrin reported little difficulty exploring the hostile land, where temperatures outside their suits varied from 180° F in the sun to -160° in the shade. Researchers had suggested a "kangaroo lope" to help them move, but the astronauts found that the old left-right earthly shuffle worked fine.

President Kennedy fretted over the first Mercury flight. A few years later, scientists feared that astronauts would suffer vertigo if they climbed out of their vehicles in space. A few years after that, some argued man would never really walk on the moon, but would have to lope like a kangaroo. Each successful shot killed some myths and constructed a step to the next flight—and new fears.



flight: Some NASA highlights

SKYLAB 2 May 25-June 22, 1973

Skylab's problems began about a minute after its unmanned launch when an 800-pound meteoroid shield was torn from the canister-like orbital workshop, ripping away one solar-power wing and jamming the other. The first Skylab crew, Charles Conrad Jr., Paul J. Weitz and Joseph P. Kerwin, went to work as soon as their modified Apollo spacecraft had ferried them to the damaged ship. They erected a sun screen over the workshop to replace the missing shield. Then they freed the jammed solar panel and repaired broken-down instruments. Some of the repairs were seat-of-the-pants. Conrad fixed a battery by hitting it. Skylab never recovered the symmetry of the original design (below), but the "fix-anything" crew saved Skylab for two later missions.

APOLLO SOYUZ TEST PROJECT July 15-24, 1975

"Tovàrich! [Friend!]" called Apollo Commander Tom Stafford as a hatchway cleared to reveal two smiling Russians. The Soyuz skipper, Aleksei Leonov, replied "Very, very happy to see you. How are things?" The meeting of five men in space after Russian and American spacecraft had docked occurred about 140 miles over Amsterdam. Detente was still alive. Russian headlines celebrated an "Orbit of Cooperation," and Stafford forced down three tubes of borscht. After the hoopla, the reentry of the American crew was a reminder of space-travel risks: Human error led to firing of thruster rockets in the air. Their exhaust made the crew choke, but did no permanent damage.

SPACELAB 1983 and beyond

Up to four men and women will be able to work in Spacelab, the comparatively commodious orbiting laboratory held in the cargo bay of the shuttle orbiter. In a shirt-sleeve environment, international teams of scientists will carry out experiments in a weightless facility equipped with microscopes, centrifuges, incubators, materials-processing furnaces and other gear. Scientists themselves need not be astronauts; some will take off after just a few weeks of instruction. Farther in the future, free-floating Spacelabs,

a step toward internationally manned space stations. If previous benchmark space shots are an indication, pioneering crews on these missions will face some tough—possibly frightening—challenges, and they will meet them.
—G.W.



Quality, they say, will out. The Pinto used to be one of those American cars with a so-so quality reputation. When we first surveyed Pinto owners back in January 1972, 42 percent rated the car's overall workmanship as "poor to average."

As time passed, the Pinto's score worsened. By 1979, 59.1 percent of its owners gave the Pinto's workmanship a "poor-to-average" rating. Meanwhile, quality among the imports was going up.

Econocar buyers absolutely won't accept so-so workmanship anymore. So quality is one area where the Escort has to beat the Pinto by a substantial margin. Does it?

It does. Of the hundreds of Escort buyers we surveyed for this owners report, the new model's quality rating ranged far higher than the Pinto's. Only 13 percent of the Escort's owners found workmanship "average to poor." Compare that



Despite smaller exterior dimensions than Pinto, Escort is "actually roomier inside."

PM OWNERS REPORT: FORD ESCORT

with the 1972 Pinto's 42 percent and the 1979 Pinto's 59.1 percent.

The Escort's 87-percent "good to excellent" workmanship score puts this car above such 1980 models as the VW Rabbit and Datsun 200-SX; also ahead of

(Please turn to page 100)



With rear seats folded, five-door wagon can carry as much as 61 cu. ft. of luggage.

Ford's first American fwd

Ford spent five years and \$3 billion developing the 1981 Escort. The Escort and its cousin, the Mercury Lynx, represent Ford's first U.S.-built front-wheel-drive cars. They replace the Pinto and Bobcat, respectively.

The Escort is currently available in two body styles: a three-door hatchback and a five-door wagon. Two sport coupe versions, the EXP and LN-7, are slated to be introduced this month.

Escorts come in five levels of trim—base, L, GL, GLX and SS. The SS marks a blacked-out, fully instrumented version with handling suspension, Michelin P165/80R13 radials and special wheels.

All of the Escorts use Ford's newly engineered ohc hemi Four with cast-iron block and aluminum head and manifold. This engine has staggered valves and it delivers 65 hp at 5200 rpm and 30/44 mpg in EPA-conducted mileage tests.

It mates with either an overdrive four-speed or split-torque automatic transaxle. The automatic steps from fluid drive to mechanical lock-up as it shifts through its ranges. The manual box is made by Toyo Kogyo.

All-independent suspension, rack-and-pinion steering, steel-belted radial tires, hide-away luggage compartment, AM radio, folding rear bench, halogen headlamps, front disc brakes and front stabilizer bar are standard on all Escorts.

In addition, most of the power accessories and convenience options which are available with the larger Ford products are also offered for the Escort.

A NATIONWIDE SURVEY BASED ON 1,087,982 OWNER-DRIVEN MILES

Enthusiastic owners cheer the Escort's economy, durability and fine craftsmanship



Owners want rear seats to fold flat.

Gear spacing too wide on manual box, owners say.

The independent rear suspension contributes to Escort's handling.

Front-wheel drive is praised by owners for traction it delivers.

PM photos: Charles Edward Lamm

If Chrysler Corp. hopes to survive, its new K-cars must succeed. Chrysler can't afford any flubs now. Chrysler knows it has to meet workmanship standards it lost in the early 1940s and engineering standards that were Chrysler hallmarks through the late 1950s.

Have the men at MoPar met these long-lost goals? We mailed questionnaires to 1,000 Dodge Aries owners and



Aries owners praise styling, but give mpg and fwd handling even higher marks. Overall quality, too, hit a new high for the corporation. In toto, owners love the car.

PM OWNERS REPORT: DODGE ARIES

found that owners like their cars. They rate the Aries far above most Dodge-built products we've reported on recently.

Owner reaction counts for a lot. Here, we'll let individuals speak their entire pieces, pro and con. We've picked a cross section of typical owners with representative comments.

A Texas insurance agent, aged 36, tells us, "I admit to buying this car partly because I want to help Chrysler make it. I've found workmanship excellent and wouldn't want a thing changed. It's a roomy, comfortable car, easy to handle, and it performs well. I've had no mechanical difficulties and am getting 23.1 mpg in the city."

From a 61-year-old New York butcher:

(Please turn to page 101)

MoPar's K-cars

Chrysler Corp.'s fate hangs by several threads, one of the strongest being the K-cars now rolling out of the company's Jefferson Avenue plant.

K-cars—or more properly the Plymouth Reliant and Dodge Aries—replace the Volare and Aspen for 1981. These twin new models are virtually identical: front-wheel drive, transverse engines, unitized bodies, rack-and-pinion steering, MacPherson-strut front suspension and twist-beam rear axle.

Buyers have their choice of three body types—two- and four-door sedans plus a four-door wagon. These come in two trim levels: Custom and Special Edition. A 2.2-liter, U.S.-made Four is standard, with a Japanese 2.6 optional. The ohc 2.2 uses aluminum for the head, intake manifold, and several accessories.

The 2.2 puts out 84 hp at 4,800 rpm, while the 2.6 rates 92 hp at 4,500. Torque figures are 111 at 2,800 and 131 at 2,500, respectively.

The Mitsubishi 2.6 appears in several Chrysler subcompacts, as well as in K-Cars, but it might soon be discontinued. Standard transmission is the manual four-speed; a three-speed automatic is optional with the 2.2 and mandatory with the 2.6. EPA estimates stand at 25/41 mpg for the two-door and 24/40 mpg for the wagon, both of them with the 2.2 engine.

Chrysler initially offered K-cars with a 30-day, 1,000-mile money-back guarantee. If a buyer decided he didn't like the car, he could bring it back for a full refund. Very few—if any—buyers did.

A NATIONWIDE SURVEY BASED ON 1,076,059 OWNER-DRIVEN MILES

Owners agree that if Chrysler bites the dust, it won't be the fault of the K-cars

More rear legroom than Aspen earns high comfort marks.

Owners love solid construction, high quality control.

Steering wheel blocks view of the tach.



Has big-car ride in a small package.

PM photos: Bill P. Maduros



Escort's 1.6-liter ohc Four delivers 65 hp, gets 28/36 mpg according to its owners.

OWNERS REPORT: FORD ESCORT

(Continued from page 98)

such 1979 imports as the Dodge Colt and Jaguar sedan; also *considerably* above domestics like the Chevrolet Citation, Sunbird, Omni and Horizon. The Escort is, in short, a well-assembled car.

A Michigan sewing-machine repairman told us, "This is the first American car I've bought where I didn't find any paint runs or excessive wrinkles in the interior, and there are no rattles."

A Wisconsin food handler: "Excellent workmanship. Nothing had to be fixed in the 4206 miles I've driven it. It equals or betters any foreign-made car. I only wish Ford had come out with the Escort five years ago."

There's no doubt that the "made-in-

America" label carried weight with many buyers. Some 16.5 percent listed that as a primary purchase consideration. But there's even less doubt that overall economy proved the *main* buying goad—as reported by 71.3 percent of our respondents.

"We were looking for a small wagon with high fuel mileage," an Alabama wife and mother stated. "Rear-seat room was a big factor in our choice of the Escort, because we felt adults really can't sit comfortably in a Civic wagon, a B-210 or Corolla wagon."

A South Carolina university student: "I had owned a VW Scirocco, and maintenance costs were eating me up. I bought the Escort because I feel it offers me economy, performance, safety and dependability."

A Texas plant operator: "American-made means parts availability. I've owned two foreign-made cars—one British, one Japanese—and found parts very costly."

And an Ohio engineer: "I bought my Escort hatchback because of its unique



Graphic display, tach are standard in up-option models. Owners want real glovebox.



Low loading sill and cargo shade garner praise; now if rear seat would only fold flat!

styling, excellent mileage rating, front-wheel drive, and lower price than such rivals as the VW Rabbit. The interior, too, impressed me as well designed—it has a finished look, unlike the Citation and Horizon."

We asked owners to list what they like best and least about their Escorts.

An Iowa painter: "I like the independent suspension all around and the fact that my SS hatchback came with standard Michelin radials—a nice touch. It gets good mileage—30/44 mpg in my case—and has very good handling, particularly in snow. It's roomy inside, comfortable, pretty, has good acceleration, and is solidly built."

A Michigan paramedic: "Great mileage, rides very well, and plenty of rear-

(Please turn to page 194)

PM'S LONG-TERM MERCURY LYNX ROAD TEST

The Escort/Lynx twins are probably the most significant cars Ford is likely to introduce this decade. They're a litmus test of the company's ability to come up with the engineering and production skills it needs to go head-to-head with the Japanese auto makers for the large subcompact market.

Needless to say, we were very curious about these cars. Would they be as good as

the competition? Could Ford really come up with a winner its first time out in the world car class?

Our answer to both questions would have to be "Yes."

The score sheet right now looks like this. We've put 7,000 miles on the car since it was new and the fuel consumption is 23 mpg in New York City traffic and 32 mpg on the high-

way. Like the 69 percent of the owners surveyed, we had absolutely no mechanical trouble. Unlike some of the owners, we didn't have cold-start problems. We even left it out for two days in near-zero weather. It fired up on the first try.

As for craftsmanship and quality, we agree with the owners. The car is very good in that respect—but not perfect. The hatch in our Lynx isn't quite flush with the body. It's weather-tight and works properly, but it just isn't fitted correctly. And, on an otherwise flawless body and paint job, that bit of misalignment is all the more noticeable.

The only other complaint we have concerns the manual gearbox. The gear spacing is too wide. It's designed for economy, not performance. But, we can forgive that—especially when you fill up and get change back from a ten.

The handling is quite good in the base model and even better with the optional suspension package which came with our car. During two full days of blitzing around the Bridgehampton race circuit it never once pulled any unpleasant surprises.

Will this be the car which will drive the imports back to their home shores? We can't say for sure, but we bet it *will* displace a lot of imports from American driveways.—T.A.



After 7,000 miles, this Lynx has proven to be economical as well as remarkably free of the bugaboos that are ordinarily found in a car's first year of production.

PM OWNERS REPORT: DODGE ARIES

(Continued from page 99)

"I've bought seven new Dodges from this dealer and have always been satisfied. With the price of gasoline always going up, I needed a car with better mileage; I'm getting 24 in town and 38 mpg on the highway. The things I like especially about this Aries are its good gas economy, the front-wheel drive in snow and its fine handling.

"As for quality," he continues, "they've really come a long way since I bought my 1976 Aspen. This is a good car. And a good-looking car—or wagon in my case—very roomy and as comfortable as my 1978 Diplomat was. But they ought to put gauges back into the instrument panel, and the jack sometimes rattles."

Now, a city treasurer, aged 57, in Michigan: "The qualities that sold me on the Aries were front-wheel drive, size, handling, economy and workmanship, in that order. I haven't been disappointed. My car is very tight and it shows signs of excellent assembly and inspection at the factory.

"There's plenty of space in this wagon; it's comfortable and good-looking. I'm surprised by the amount of legroom in all seats, and the car rides silently and well. I have the 2.2-liter engine, which so far is delivering 25 mpg in the city and 40 mpg on the highway, as advertised. I've had no mechanical problems."

An upstate New York maintenance electrician, aged 24: "I bought the Aries because I like Chrysler products and wanted to buy American. For the price, it's a good little car, although the discount wasn't all that great. I wish I'd waited, because now they're making better deals.

"I'd rate workmanship as good. There's a lot of plastic in the car, but it all sounds solid. There's enough legroom for four adults and a fair amount of trunk space in the sedan. Four doors make it easy for older people to get in and out, and the



U.S.-built 2.2 and Mitsubishi 2.6 Fours are available. Both will offer good economy.

would get better mileage than my Buick and I preferred the Aries over the Chevrolet, Rabbit and Citation. I've had no trouble with the car, but the dealer had to install the heater and fix a defroster rattle. He gave me a loaner and did the work promptly.

"I simply love the car—there's nothing about it I don't like. I'd prefer higher in-town mileage, but the Aries does better than my father's Citation. The engine performs well and acceleration is good. It's roomy, beautiful and easy to maneuver."

Next, a 47-year-old Michigan high-school counselor: "Right after we got the car, the speedometer quit. I fixed it myself—all it needed was the cable shoved farther into the transmission. Shifting has also been hard. The dealer made it a little easier, but it's still hard to get into second. General workmanship, though, is good: no rattles. It's a sound and solid car. Body is excellent. It's roomier than you'd expect, and it has a comfortable ride. Front-wheel drive gives a very controlled feeling on all surfaces."

A 34-year-old engine tester from New York: "I'm no expert, but after 18 years of driving, I've owned 53 cars—19 of them new, mostly GM and VW—and I've been a service manager for Fiat, VW, MoPar and Chevy. In my opinion, this Aries has to be the best dollar value around today. It has fuel economy and room for six people. Everything fits. I didn't have to adjust anything, as I've done so often in the past. And its seats are totally comfortable on long trips.

"The only repair I needed on this car was a choke adjustment. It's a pleasure to see the dealer fix it right the first time and return the car as clean as it was when I handed him the keys. I'm particularly impressed with the 2.2-liter engine's power and economy, the roomy interior, ride, silence, handling, styling, traction, trunk space and engine serviceability. My only suggestion would be to move the speedometer so I don't have to duck my head to see it. The steering wheel interferes."

A 30-year-old knitting-machine mechanic from Minnesota: "I'd been looking for a fwd car with good mpg, good interior room and a comfortable ride. The Aries filled that bill. And I got a good deal. The dealer didn't start high and then come down—he offered me the best deal right from the start, which was \$300 less than I was expecting to pay.

"The Aries' quality is good, but it still leaves something to be desired. No mechanical problems except the brakes needed bleeding. For the size of this car, there's a lot of interior space and rear legroom. I'm averaging 20 to 30 mpg, but the car only has 1,500 miles on it and should do better once it's broken in."

An Ohio millwright, aged 48: "Just before Christmas, we had a six-inch snowfall, and the K-car went around everything—absolutely marvelous bad-weather handling. Front-drive handles very well on snow and in the wet, yet it's a comfortable, good-riding car. Unfortunately, the EPA estimates aren't realistic.



Bench front seat can accommodate three in a pinch and is very comfortable for two.

I'm getting 27 mpg tops, not 40 to 41. Also the car could use better instrument lighting and a larger gas tank."

Half our respondents were over the age of 50. Here's a 61-year-old retiree from California: "We bought the Aries primarily for fuel economy. I average 25 in town and 32 on the highway. I've had no mechanical problems. The salesman was excellent—no high pressure, very courteous and willing to help. Workmanship looks good, the car handles great, corners well, feels and rides like a much bigger, heavier auto. There's nothing we don't like about it."

A 57-year-old retired Alabama air-traffic controller: "The initial test drive sur-

(Please turn to page 195)



Some drivers would prefer functioning gauges; others didn't like day-glow dials.

front-wheel drive is excellent in snow. My only negative comments are that the 2.2-liter engine needs more snap and the dashboard lights reflect in the windshield at night."

A Texas special-education teacher, 37 years old: "I wanted a smaller car that

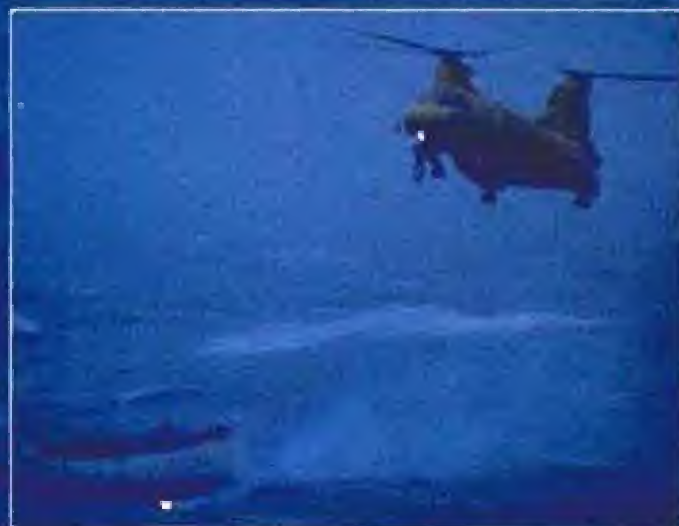
THE PRINSENDAM FIRE

HISTORY'S GREATEST SEA RESCUE

It took extraordinary efforts in the air, on land and sea, plus an incredible run of good luck, to save 524 people in the treacherous Gulf of Alaska.

by Josh Eppinger

Background photo shows one of two Canadian Forces CH-46 helicopters which flew north from British Columbia to aid in rescuing survivors from the liner *Prinsendam* in the Gulf of Alaska. Locating one of *Prinsendam*'s lifeboats, chopper moves in (inset) to make pickup.



Color photos courtesy of Canadian Forces' *Sentinel* magazine



Passenger ship *Prinsendam* position 57-38° N., 140-25 W. Fire. Fire in engine room. Flooding engine room with CO₂. Conditions unknown. Passengers 320. Crew 190.

In the command post of the U.S. Coast Guard's Rescue Coordination Center atop the seven-story Federal building in Juneau, Alaska, the quiet of an early-morning duty shift is broken by the clacking of a teletype machine lining out the message above. It is the first alert in what is to become the most successful large-scale peacetime sea rescue in history. It is Oct. 4, 1980.

The spare message carries some awesome details. Fire at sea is the mariner's worst fear. Quickly, plotters pinpoint the vessel in the Gulf of Alaska, some 120 nautical miles south of Yakutat, the nearest village, on Alaska's southeast coast.

Aiding vessels in distress is the Coast Guard's stock

Photo sequence shows the death of *Prinsendam*: At right, acrid smoke pours from the liner as the fire that began in her engine room moves upward and forward. At this point she is adrift, and her bridge is intact...

...But hours later, under tow, *Prinsendam* is totally fire-ravaged. Water can be seen pouring from ports blown out by explosions as ship rolls in mounting seas and begins listing dangerously to starboard...

...Bottom photo shows list from aft perspective. At right is the last photo taken as the ship lies nearly on her beam ends, cut adrift again, before sinking in 8,000 feet.



Photos courtesy of U.S. Coast Guard



in trade, but the numbers in the cable's final line, coupled with the ominous "condition unknown," herald an operation far beyond its routine scope.

Adm. Richard Schoel, roused from sleep at his home, arrives at headquarters to take charge. On a huge map covering one wall of the operations room, Schoel plots the available forces against one small target, the *Prinsendam*.

Schoel moves quickly. He assesses the availability of all of his immediate command—and more, since the magnitude of this mission leaves him no choice. Sweeping from west to east, Schoel lines up the deployment:

■ Coast Guard Rescue Coordination Center (RCC) on Kodiak Island—two HH-3 helicopters and two HC-130 aircraft. Distance: 250 nautical miles from *Prinsendam*.

■ Alaskan Air Command RCC, Elmendorf Air Force Base, Anchor-

“No matter how many cruising adventures you’ve thrilled to in the past, this is the one you’re likely to remember the longest.”

—*Prinsendam* brochure

age: one HH-3 helicopter and one HC-130 Hercules. Distance: over 370 nautical miles.

■ Coast Guard RCC, Sitka: Two HH-3 helicopters. Distance: 170 nautical miles.

■ Canadian Forces from British Columbia: Two CH-46 helicopters, one Argus and two Buffalo aircraft. Distance: over 600 nautical miles.

■ Coast Guard cutter *Boutwell*, docked in Juneau for centennial celebrations. Distance: 300 miles by sea.

■ Coast Guard cutter *Woodrush*, docked in Sitka.

■ Coast Guard cutter *Mellon*, on patrol near Vancouver. Distance: 550 nautical miles.

The *Prinsendam*'s alert has also been received by the *Williamsburgh*, a 1,000-foot supertanker located five hours (90 nautical miles) south of the *Prinsendam*. The *Williamsburgh* is bound for

(Please turn to page 211)





RESCUE OF THE PRINSENDAM

A game in which skill and luck play equal parts

Without taking away from the superb coordination, airmanship and seamanship employed in the *Prinsendam* mission, the rescuers had to have had luck breaking their way at several key points. In that respect, it was more like a backgammon game than chess.

Had not the *Williamsburgh*, largest supertanker ever built in the United States, been just five hours south of the liner when the emergency was broadcast, what then? Had not the *Williamsburgh* been fully loaded with Texas-bound crude, providing the stability needed for helicopter

operations off its foredeck pad, what then? Had not the Air Force HH-3, the only in-air refuelable chopper, been able to cut hours off its flight time to the ship by negotiating normally fogbound (in October) Portage Pass, what then? Had not the *Sohio Intrepid* been standing by when the USAF HH-3

ran short of fuel in low visibility (its CH-130 tanker plane having escorted a crippled Canadian chopper to Yakutat), what then? Had not the cutter *Boutwell* found lifeboat No. 6 hours after all were thought accounted for—until an Air Force colonel phoned to ask after his parajumpers—what then?



1 Living room features a do-it-yourself greenhouse that helps boost the comfort inside.

2 Multilevel deck that you add boasts space for entertaining. Plans are in this issue.

3 Hanging planter and open wall shelves are two projects that will appear in a future issue.

4 Entertainment center houses stereo and TV. Here, it is between the dining room and back door.

5 Entertainment center closes to reveal fabric-covered doors. We'll have plans for this, too.



PM's vacation home: Add-ons turn a ready-made into a sunlit retreat

Innovative building and super do-it-yourself projects make this house stand out from the pack.

by Harry Wicks HOME AND SHOP EDITOR

For the second time in less than three years, *Popular Mechanics* has spearheaded an effort to create a lot of house for relatively little money. We succeeded because of the talented and dedicated people that we worked with—at Wick Building Systems Inc., and Armstrong World Industries Inc. We all agreed that it was possible to create a fine home geared to living in the 1980s—but priced at a pre-70s figure. What it would take to create such a project would be imagination, creativity and lots of old-fashioned hard work. You see the results

on these pages—about 2,400 square feet of living space that can be purchased for under \$48,000. That price includes the wooden foundation. Without the foundation, the basic factory-built home is \$30,000. Also, the size of the home will vary slightly from one part of the country to the next, depending upon local preference; thus, the price, too, can vary, depending upon the size of your house.

By building an all-weather wood foundation under the PM house, we effectively doubled the living space of a standard - model





6 Finished basement in the PM house features an elevated workout deck for physical fitness buffs.

7 Handsome blinds behind the deck open to reveal a fully equipped workshop that will satisfy most.

8 The heart of this workshop is the Shopsmith Mark V, which makes all types of woodworking possible.

9 Bar and buffet table are located in otherwise lost space in the basement, between lally columns.

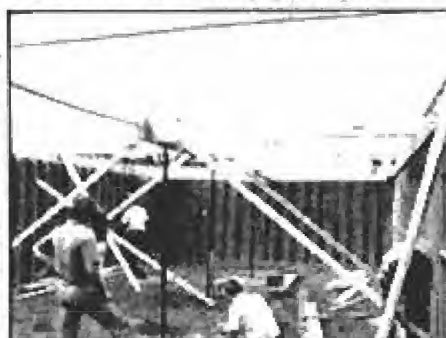
10 For gracious living, build this bed serving table. When not in use, park it over dresser at the foot.

home produced by Wick. By designing in a great number of do-it-yourself projects, we were able to produce a highly personalized home with a custom-built look. The projects which set this house apart from its neighbors and which are *not* included in the basic home are:

- Multilevel front deck.
- Handy carport at the rear.
- Greenhouse in the living area that lets lots of sunlight in.

HOW THE PM VACATION HOME CAME TO BE

Popular Mechanics' commitment to help solve the housing crisis in the United States was made more than three years ago. In September 1978 (page 106), we presented the first PM vacation house—a year-round design to provide a great deal of house for relatively little money. The knowledge we gained developing the first house, along with input from readers, triggered some excellent and, in fact, unique ideas for a second PM vacation home. But the ideas were just that until we could join forces with a major manufacturer of home building products, Arm-



Wood foundation sections are made in factory, hauled to job for installation.

strong World Industries Inc., and a forward-thinking builder of manufactured homes, Wick Building Systems Inc.

The first notion that must be dispelled is that a mobile home is just a "box" that is pulled behind a pickup truck, and parked willy-nilly on a lot. Mobile—in manufactured housing language—simply means that the house sections are built in a factory, then trucked to the building site for assembly and installation. The PM vacation home, for example, is brought to your site by two trucks. It's assembled and ready for occupancy seven working days after delivery.

Innovative thinking

The big design advance in this home is the doubling of living space for proportionately fewer dollars. For example, the basic dwelling provides 1,200 sq. ft. of living space at a cost of approximately \$30,000; this comes to \$25 per sq. ft. But, for an additional \$18,000, you can have the dealer install an all-weather wood foundation (AWWF) beneath the home—linked to the first floor with a circular stairway—and thus double the space. The cost for the basement space comes to \$15 per sq. ft. If you take the total cost of the two combined (\$48,000) and divide it by the total

sq. footage (2,400), you finish with a well-built home for \$20 per sq. ft. That figure is impressive when you consider that an FHA-insured, site-built home these days costs more than \$40 per sq. ft. to produce.

The basement in the prototype home is constructed of pressure-treated lumber. Tests have shown that such a wooden foundation will last as long as a concrete one; those who have lived with both tend to prefer the wooden version because of its greater comfort and warmth over cold and damp concrete.

Do-it-yourself projects

Your involvement as an active do-it-yourself-homeowner will make the home worth even more. The handsome redwood deck, for instance, which requires a cash outlay of about \$4,000 for materials, would be an \$8,000 job if you had it contractor-built. Similarly, the functional greenhouse could cost close to \$7,000 if contractor-built. But, by building it yourself, your cost should be somewhere around \$3,000. The most expensive element is the glass, or sheet plastic.

The home is designed to comply with the federal standard for mobile homes established by the Department of Housing and Urban Development (HUD) to assure conformance to exacting materials and construction requirements. There are also varying structural and thermal regional differences



Factory-built house is lowered onto the foundation, which must be accurately built according to homebuilders' plan.

(in manufactured housing) with which the manufacturer complies.

The home is protected by a one-year manufacturer's warranty against defects in material and workmanship. For information about the home and/or authorized dealers, write to Wick Building Systems at the address shown in the list at right.—H.W.

CREDITS

Home manufacturer: Wick Building Systems Inc., 3212 West Park Row, Arlington, Tex. 76013
Builder: Buddy's Homes, 8500 South Expressway, Jonesboro, Ga. 30236.
Wood foundation: Home Construction Co., 1325 North Decatur Rd., Atlanta, Ga. 30306; technical consultant: American Plywood Assn.
Local manufacturer: Artcraft Homes, Div. of Wick, Winder, Ga. 30680.
Project coordinators: Robert McKown, Armstrong World Industries Inc., Lancaster, Pa. 17604 and Harry Wicks, *Popular Mechanics*.
Construction supervisors: Buddy Parham, Donnie Russell, Buddy's Homes.
Factory technical consultants: Dwight Bliss, Don Dryry, Lew Richardson.
Interior design: Debbie Seaburg, ASID, Armstrong, and James McGinn, Wick Building Systems.
PM photography: Gary Bradt.
Deck, greenhouse design: Gilbert Benson, Armstrong.
Project designs: John Gaynor, Debbie Seaburg, Eugene Thompson, Harry Wicks.

SHOPPING INFORMATION

Exterior siding: Windridge pattern composition hardboard siding: Champion International Corp., Building Products Div., 1 Landmark Sq., Stamford, Conn. 06807.
Paint: Glidden, 900 Union Commerce Bldg., Cleveland, Ohio 44115.
Windows and patio doors: Kinro Industries, Box 639, Mansfield, Tex. 76063.
Redwood deck: California Redwood Assn., 1 Lombard St., San Francisco, Calif. 94111.
Interior wall paneling: First floor: VanPly, Box 668289, Charlotte, N.C. 28266; and, Decor, Box 111, Fairfield, Ala. 35064, Basement: Georgia-Pacific Corp., 900 Southwest Fifth Ave., Portland, Ore. 97204.
Resilient floorcoverings, carpeting, ceilings, furniture: Armstrong World Industries Inc.
Circular stairway: Mylen Industries Inc., 650 Washington St., Peekskill, N.Y. 10566.
Woodburning stove: Fisher Stoves Inc., 19331-T, 21st Ave. W., Lynnwood, Wash. 98036.
Heating/air conditioner: The Coleman Co. Inc., Box 1762, Wichita, Kan. 67207.
Windows, patio doors: Kinro Industries, Box 639, Mansfield, Tex. 76063.
Countertops, table laminates: WilsonArt, a div. of Ralph Wilson Plastic Co., 600 General Bruce Dr., Temple, Tex. 76501.
Blinds: Fairfax, 3018 Lincoln Ct., Garland, Tex. 75041.
Lighting: Triangle Home Products, 945 East 93rd St., Chicago, Ill. 60619.
Appliances: Range, refrigerator, dishwasher, microwave oven, washer and dryer by General Electric Co., Appliance Park, Louisville, Ky. 40225.
Deck furnishings: John Hancock Furniture Mfg. Co., Box 269, San Diego, Calif. 92112.
Barbecue grill: Charminglow Products, Box 127, Bristol, Wis. 53104.
Workshop: Shopsmith MARK V, Shopsmith Inc., 4530 Wadsworth Rd., Dayton, Ohio, 45414.
Hand tools: Stanley Tools, 195 Lake St., New Britain, Conn. 06050.
Portable power tools: Black & Decker Mfg. Co., 701 East Joppe Rd., Towson, Md. 21204.

- A hanging redwood planter and open storage shelves in the kitchen.
- Contemporary triangular tables and a coffee table in the living room.
- A breakfast-in-bed serving table, which can be parked over a foot-of-the-bed dresser when not needed.
- A two-person, work-at-home desk setup (not shown), which makes use of simple construction to create a very handsome and functional arrangement.

- A bar-buffet table arrangement in the basement.
- A basement workshop with a simple workbench that will solve your workshop needs when you're in the country.

The PM home is available through Wick Building Systems' Northern and Southern divisions. A total of 12 dealers have agreed to build the home—without the do-it-yourself projects—so that readers can see for themselves firsthand. The dealers who have elected to display homes

are listed at the end of the story. For a list of dealers, write to the home manufacturer at the address given in the credits.

A better leisure home

Besides saving money, the do-it-yourself projects set this home apart from the conventional manufactured home. Some of the owner-built add-ons are like those occasionally included in custom-built homes, but rarely featured in manufactured

(Please turn to page 220)



PROPPING UP



Nacelle's faired end faces the wind as it swivels 260 feet above the ground.

FIBERGLASS
ROTOR

LOW-SPEED
SHAFT ASSEMBLY

HYDRAULIC
ACTUATOR

ROTOR BRAKE AND
LOCK ASSEMBLY

SPRING-CONTROL
DAMPS SWIVEL

SLIP RINGS (NOT VISIBLE)
TRANSFER GENERATOR
CURRENT

A MONSTER

An old-line airplane propeller company outdoes itself in engineering the biggest and most powerful windmill on earth—or in the air.

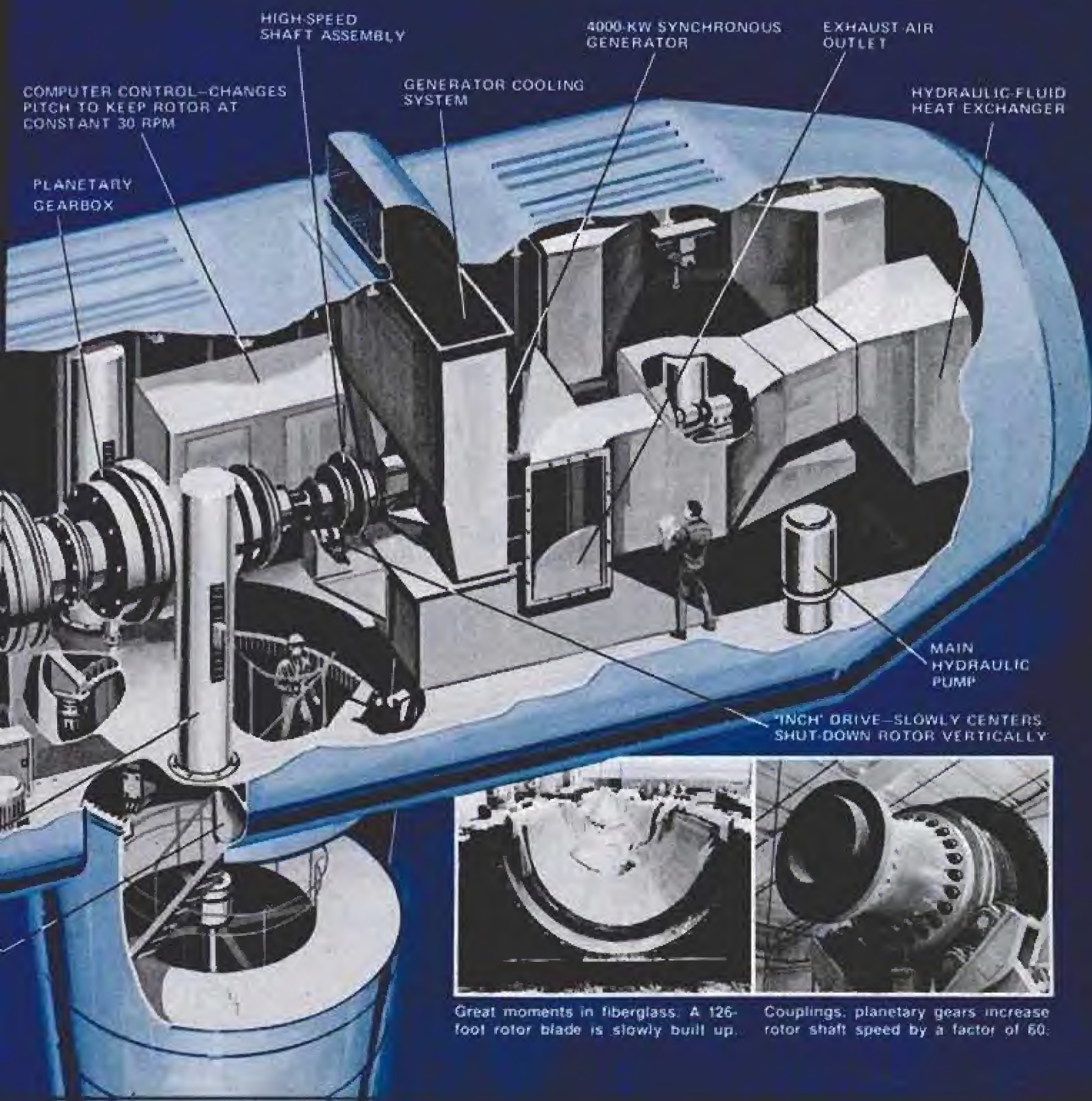
by Mort Schultz

The world's largest propeller—257 feet from tip to tip—is being reared by Hamilton Standard (now a division of United Technologies), the same company that built the prop for Lindbergh's *Spirit of St. Louis*.

Appropriately, the giant blades will twirl about the business end of the world's largest windmill. It's no pie-in-the-sky scheme on some drawing board: either installation of the giant system at Medicine Bow, Wyo., under the aegis of the Department of the Interior, will be

underway by October. Once it is whirling in the winds (which more than half the time average over 33 mph—the point at which the generator reaches rated power)—above Medicine Bow, the unit is expected to supply about twice as much electrical power as the current world's largest windmill, the government's experimental system in Boone, N.C.

If it proves out, the projected next phase would be the installation of multiple units of the same design—an entire Wyoming "farm" of mammoth wind machines. **PM**



Great moments in fiberglass. A 126-foot rotor blade is slowly built up.

Couplings: planetary gears increase rotor shaft speed by a factor of 60.

The cars we can't get here



CITROËN CX



There are cars on European roads that very few Americans ever see and that even fewer get a chance to drive. Some of these cars, like the Fiat Panda, are masterful exercises in efficient packaging. Others, like the Opel Senator, are refined, highly engineered sedans that combine the best of European sportiness with American luxury. And still others, like the Suzuki SC-100GX, make even the most fuel-efficient American cars look like base gas guzzlers. The problem is, we can't buy any of these cars.

In fact, they're illegal. If you're clever enough to slip one through

Aerodynamic, full-sized Citroën CX diesel delivers up to 38.5 mpg and has top speed of 97 mph. We found it quiet, super-smooth riding and full of gadgets. That ball on the dashboard is an ashtray. As in all Citroëns, engine drives the front wheels.

OPEL SENATOR



The German Opel Senator rivals BMW and Mercedes in most aspects of engineering, performance and handling. All-independent suspension, four-wheel disc brakes, injected ohc Six complement excellent craftsmanship and very comfortable interior appointments.



Dozens of cars on European roads have never been seen here because they aren't sold in the United States. PM took the Grand Tour to find out what they are like to drive.

by Michael Lamm WEST COAST EDITOR

Customs, and you're caught on the road, it could cost you a year in jail and a \$10,000 fine—plus the loss of the car.

Is the American car buyer getting cheated out of some really interesting and super-fuel-efficient cars? At a time when fuel efficiency is so important, why can't we import something like the Panda or the Suzuki which get superb mileage?

I put that question to a U.S.-based Ford spokesman and his answer came as something of a surprise.

"It cost us (Ford) roughly \$100 million to federalize the Fiesta back in 1976. Today that



MINI 1275-GT



SCIMITAR GTC

Sport model BL Mini 1275-GT (top) combines good performance with 33.6-mpg city fuel economy. There's lots of room for four, despite 80-inch wheelbase. Fiberglass-bodied Scimitar GTC convertible (above) uses Ford 2.8-liter V6. It handles well and shows excellent workmanship.



Dent- and chip-resistant plastic covers grille, rear bumper and rocker panels of Panda by Ital-Design. This new Fiat can deliver 40.7 miles per U.S. gallon, yet doesn't suffer from below-par horsepower.



Sedan deVille vs. Fiat Panda



Another tiny commuter vehicle, the Fiat 126 (right), boasts engineering like the Suzuki's. Among the clever touches, removable radio can be used as a portable.

figure would be much higher due to inflation."

Of Fiesta's \$100 million federalization, \$80 million went toward meeting government emissions and safety standards. No one is suggesting these standards be scrapped, but they're an economic fact of life that every importer has to face.

So, even a multina-

tional automaker like Ford can't casually make a decision to bring a car into the country. It's a huge undertaking, involving tremendous sums of money and time—commodities that are in short supply in Detroit these days.

Given these realities, I still see a

lot of cars out there in the rest of the world that would feel mighty comfortable here in America.

I recently got a chance to drive, and live with, some of these interesting strangers, and the experience brought home to me what we're missing. These are *not* automotive





Fiat Panda's seats have seven positions.

Fold seats flat and you're on double bed.



Citroën's little Visa Club has an air-cooled, horizontally opposed Twin and fwd. PRN Satellite cluster is a compact and efficient packaging job.

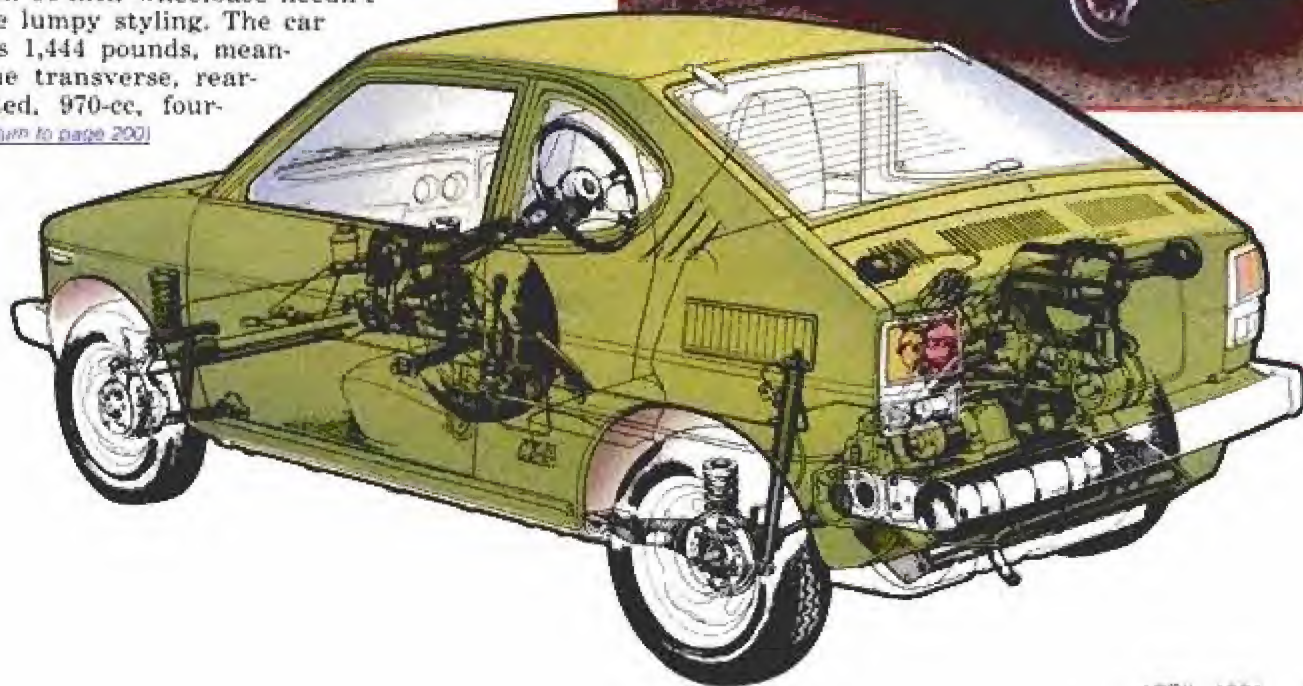
curiosities. They're totally practical, often multipurpose, usually economical, generally well-built machines that you'll find running on British and European roads every day. But, alas, you may never see them on our own highways.

Suzuki SC-100GX

Britain puts an informal limit on the number of Japanese imports allowed into that country each year. The result is that Japanese cars tend to be in great demand, with prices higher than they'd be here.

The Suzuki SC-100GX is a cute, petite 2+2 that's all biz and very little buzz. It's fun to drive and shows that an 80-inch wheelbase needn't dictate lumpy styling. The car weighs 1,444 pounds, meaning the transverse, rear-mounted, 970-cc, four-

Tiny Suzuki SC-100GX combines cuteness with spunky acceleration. It is fine for two people, but the cramped rear seat is for kids only. The back glass lifts for access to cargo area. For the right price, this Suzuki, could revolutionize commuter market.

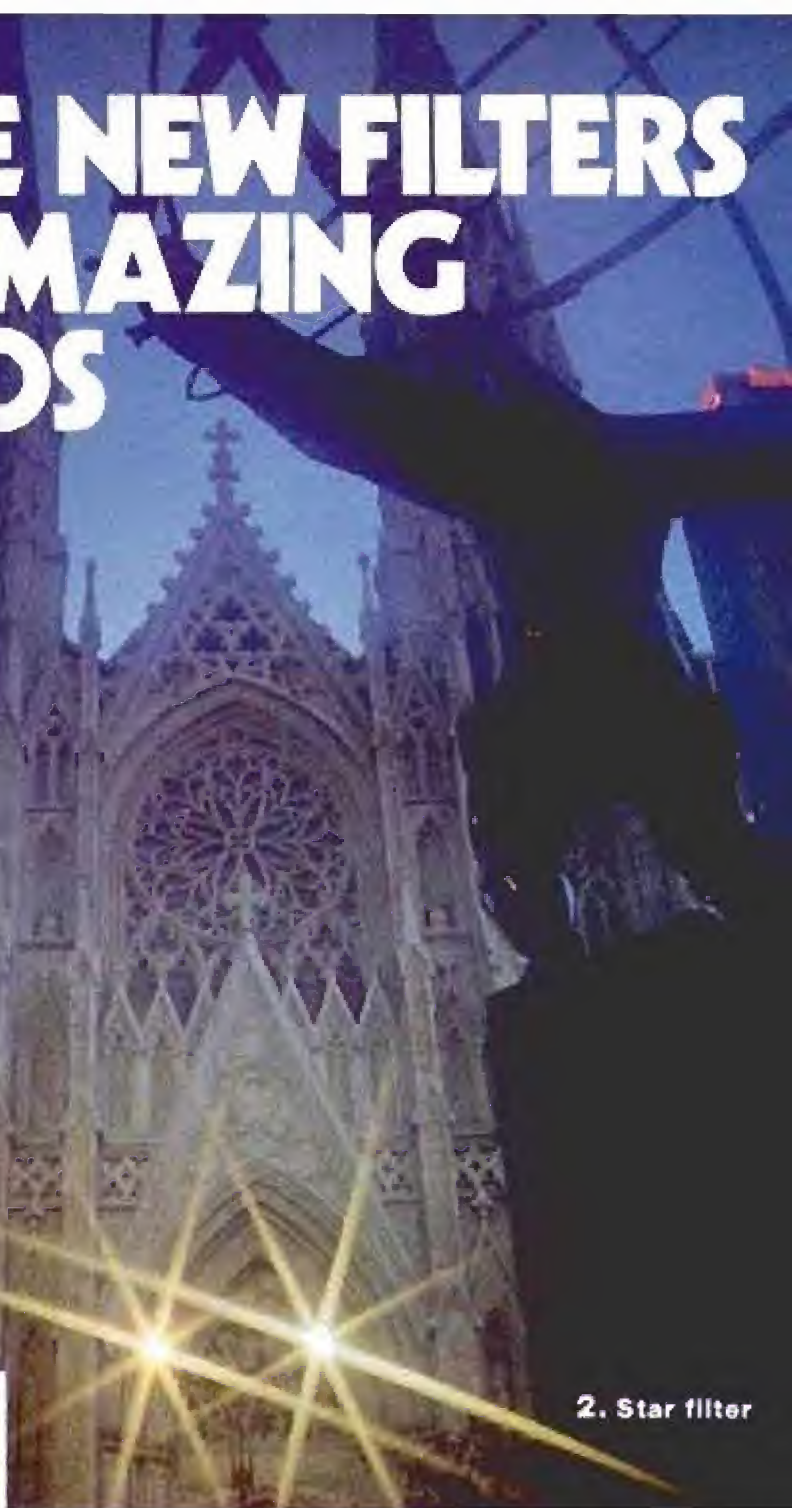


(Please turn to page 200)

THESE NEW FILTERS CREATE AMAZING PHOTOS



1. Neutral-density and warming filters with zoom lens



2. Star filter

A new system of special-effects filters from Cokin promises to make every photographer a star—or will at least make starry effects easier to achieve. The filters also make multiple images, startling skies and softer portraits as easy as clicking the shutter.

The foundation of the system is a filter holder that accepts up to three of 75 special filters at the same time. The filters may be moved up and down in the grooved holder and rotated together or independently.

This filter holder allows the photographer to do anything he might imagine the wide range of filters to be capable of. And the extraordinary versatility of the Cokin system makes an astronomical number of special effects possible.

Graduated filters

Add color to a drab sky or make a sunset sensational—without altering the foreground colors. These

(Please turn to page 221)

Easy-to-use filters help you turn a sky pink, shoot multiple images or soften a portrait.

by Bob Berger

PM photos by the author



Cokin filter system consists of 75 special-effects filters and some other attachments. Above, we show some of the most useful for amateurs.

1. A neutral-density filter was used with a warming filter to allow for a long-enough exposure to zoom a lens during the shot of the colorful horse.

2. The beauty of St. Patrick's Cathedral is vivid with a star filter.

3. A split-field filter keeps the autumn leaves looking as crisp as the bright, new Mazda RX-7.

4. A center-spot filter gives an aura of softness to our model's image.

5. Tennis players are covered in rainbows, using a diffraction filter.

6. A Park Avenue scene in New York becomes a kaleidoscopic wonder with a multiple-image filter.

7. A graduated pink filter was used to turn the sky pink behind our model.





9 ways a professional

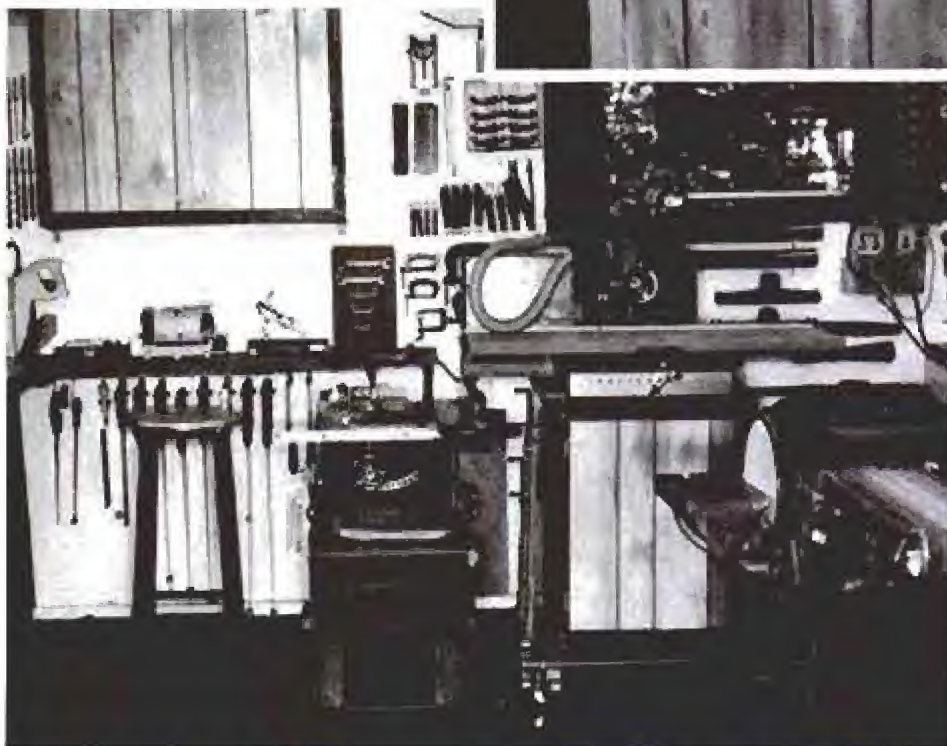
A place for everything,
and everything in place
is the way of life in
this well-organized shop.

by Jorma Hyypia

Few workshop problems are more frustrating than being unable to find that certain tool or jig when you know it's around somewhere. Projects may even be discouraged through lack of organization. That was the situation in my garage workshop before organization fever struck. Catch this bug and you, too, will be surprised how inventive organizing a workshop can be. I suggest that you start by clearing everything out and cleaning up the space. You might even repaint. The walls in my workshop are now a cheery, buttercup yellow.

After all the junk has been tossed out, lay out tools and useful materials in function-oriented groups. This will give you an idea of how much space is needed for storage of each group. Consider ways in which valuable floor space can be saved and made flexible for a variety of activities. Once you're satisfied with planning, go to work.

1 Group tools by use



All similar tools (saws, clamps and wrenches) are stored in the same areas. To gain valuable work space, the table saw on wheels rolls partially under the radial table saw.

2 Keep tools nearby

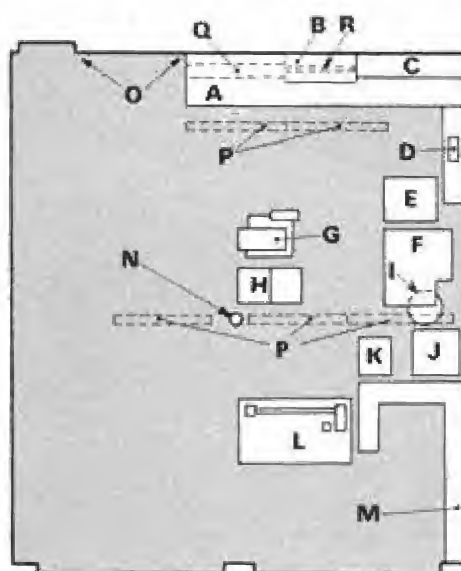


Easy access is important in this workshop. Bits and accessory tools for drill press are to the immediate left of the machine.

keeps his shop organized



In this carefully planned workshop, all available space is used for handy storage of tools. Good lighting is a must.



4 Design a floor plan

FLOOR PLAN—WORKSHOP

Key	Description
A	Main workbench
B	Cupboard (portable power tools)
C	Nail, screw and bolt storage shelves
D	Grinder bench (handsaws below)
E	Table saw
F	Radial-arm saw
G	Belt and disc sander
H	Sabre saw and router table
I	Roll-out shop vacuum
J	Storage cabinet (old dishwasher)
K	Drill press
L	Lathe table
M	General storage shelves
N	Lally column
O	Tool storage wall
P	4-ft., single-tube fluorescent light
Q	4-ft., double-tube fluorescent light
R	3-ft., single-tube fluorescent light

Note: Overall garage dimensions are about 19½ x 22 ft.

5 Make lift-out doors

Conventional doors under a workbench have drawbacks. Sliding doors leave the storage space half-closed. Conventional doors require swinging space at cabinet front. The door shown solves both problems. The 28 x 60-in. door is hinged at the bottom to swing open bin-fashion. When you need repeated access to the storage space, the entire door can be pulled out. Reinstallation takes only seconds.

First, bore the dowel holes in a length of 2 x 4 to size. Bore the holes 3 in. deep and about 8 in. from the ends. Rip the 2 x 4 down the middle to make two pieces about 1½ in. wide by 1½ in. thick. Keep the cut-edge sides

face-to-face so dowel holes remain aligned; then attach one piece to bench or to legs to form stationary rail. Mark and set butt hinges as shown on the other rail and door-frame rail. A ¼ x ½-in.-deep groove was cut in door frame to suit panel. Assemble the door with nails and glue.

MATERIALS LIST—REMOVABLE DOOR

Key	No.	Size and description (use)
A	2	1½ x approx. 11½ x 60" upper and lower rails (ripped from same 2 x 4)
B	2	¾ x 2 x 60" mitered rails
C	2	¾ x 2 x 28" mitered stiles
D	1	¾ x 25 x 57" finished panel
E	1	½ x 1 x 28" stiffener
F	4	2½" corner irons (Stanley No. SP999)
G	2	2" butt hinges (Stanley No. 608BP)
H	2	¾ x 3" wooden dowels
I	2	5¾" door pulls (Stanley No. CD482)

Misc: Carpenter's glue, 10 wood screws

3 Increase storage areas

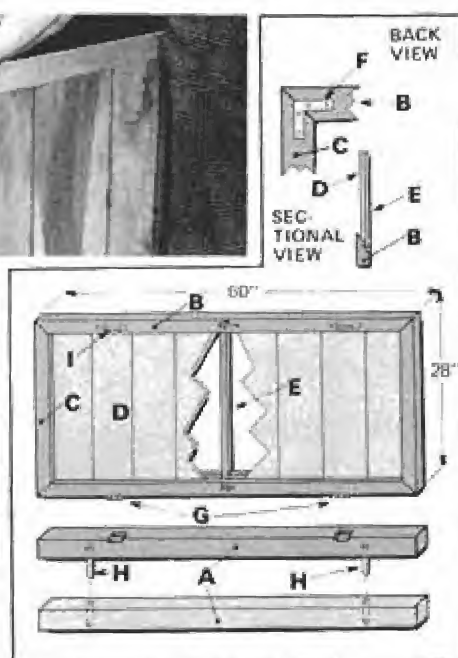
By reinforcing the legs of this old table with ½-in. plywood, it is stable enough to support my wood lathe and it provides more storage space in the process. I left mine open underneath, but if more shelving is needed, this would be ideal.



Plywood skirt on a salvaged dining-room table provides storage for lathe tools. Area beneath the table stores large items.



Pull top of door out slightly and lift evenly on door handles to disengage dowels. Lightweight door can be set aside for full access to storage under the bench.





Baby-food jars can store nails, screws, nuts, plus assorted items. Larger bottles aligned on the lower shelf hang by caps screwed to shelf. Attach caps with one centered roundhead screw and one off-center brad to keep cap from turning.



6 Store items in jars

As numerous shop owners discovered long ago, baby-food bottles are ideal keepers for storing all kinds of small items. In my shop, I changed several large shelves above my workbench to accommodate over 100 of these jars. By adding a smaller shelf between, I could fit three rows and still have space left on the wider shelves for tools I want to keep nearby temporarily, but not cluttering the workbench.

If you want to hang the larger bottles from underneath as shown, allow adequate finger clearance when attaching the caps; otherwise the jars will be difficult to loosen. Stick-on labels should be used to identify those jars with similar contents. I also recommend a small utility light—like the gooseneck lamp shown—for sorting and selection.

7 Combine tool tables

This combination table serves two useful purposes: It keeps the router and sabre saw (used as substitute shaper and jigsaw) handy at all times and saves floor space by combining the two tools into one fold-up unit. The framework shown was originally used to hold industrial electronic equipment; it was salvaged from the local dump. Admittedly, you won't find a duplicate, but it would be easy to build a similar

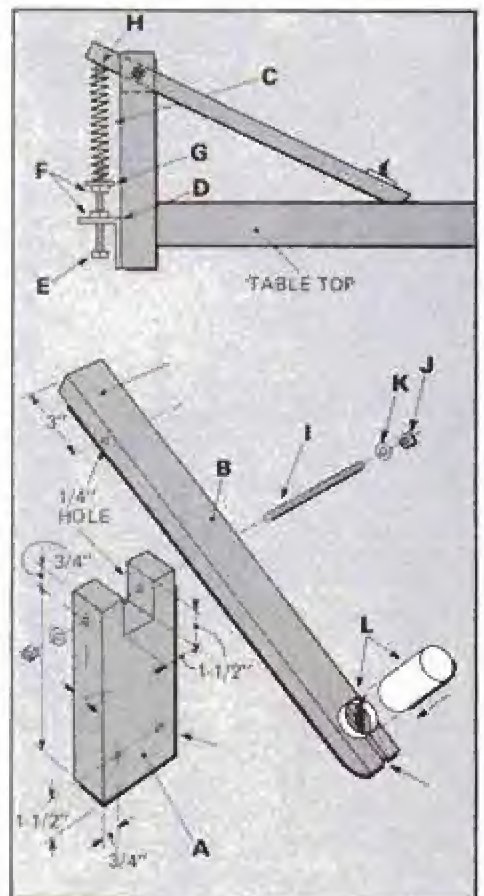
MATERIALS LIST—HOLD-DOWN ARM

Key	No.	Size and description (use)
A	1	8" 2 x 4 vertical support
B	1	3/4 x 1 1/2 x 14 1/2" arm
C	1	compression spring
D	1	3 1/2" long, 1 1/2" angle iron
E	1	1/4" machine screw
F	2	nuts
G	1	washer
H	1	dowel (spring retainer)
I	1	1/4 x 4" threaded rod
J	2	nuts
K	2	washers
L	1	pill bottle and cap

table from angle iron welded or bolted together, or even from wood.

The easiest way to mount the sabre saw on the top level is to use a commercial sabre-saw table that comes with saw-mounting and accessory hardware to make the tool a jigsaw. I added a wood frame around the metal saw table to custom-fit it to the slightly larger framework.

You can also add a hold-down, spring-loaded arm as shown in the photo. By fastening a plastic pill-bottle cap over the slotted working end of the arm, you protect the sabre saw blade.



Salvaged metal frame provides a handy place for sabre saw table on top level, and makes the router a shaper on the lower slide-in table. Commercial saw table was adapted to the stand dimensions by adding a frame. An optional hold-down arm includes a "pill bottle" safety feature to protect the blade.



8 Hang saws teeth in



Handsaw stores under a narrow shelf. Clips hold larger saws; a coat-hanger wire is bent to grab the smaller saws. A closed loop in wire is attached to shelf bottom with a screw eye. Saws stored this way need less space while the blade teeth remain well protected.



Spaced pair of dowels keeps saw tips from swinging; install them by using 8d nails.

Most people store their handsaws flat, and by doing so use space that is better left to other things.

I created the storage system shown under my 8x48-in. grinder shelf.

The 2 3/4-in. spring clamps hold the top of my large saws securely, while the two 1/2-in.-thick dowels on the bottom serve to keep each blade aligned.

It works best if these dowels are loose enough to turn when the blade is inserted. Smaller saws can be hung either from wire hooks, or from finish nails that have been driven into the wall.

MATERIALS LIST—VISE

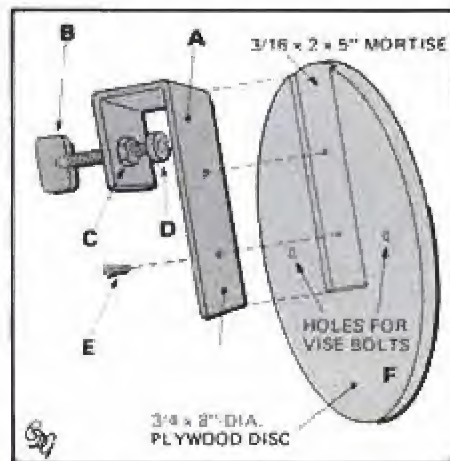
Key	No.	Size and description
A	1	3/16 x 2 x 9 1/2" flat iron bar
B	1	4" thumbscrew
C	1	nut, welded to flat iron
D	1	collar to suit nut
E	2	3/4", No. 7 th screws
F	1	3/4 x 8"-dia. plywood disc

9 Make a roaming vise



Roaming vise uses clamp that came from dough mixer. It's an easy-to-make clamp.

An extra vise can be converted into a roaming vise by mounting it on a piece of 3/4-in. plywood and then clamping this unit wherever it's needed. You can make your own clamp by bending flat-iron bar stock into a U-shape and welding a large nut on the lower arm to accept a wing bolt. If the vise vibrates when doing heavy work, just slip a thin wood shim between the base and the bench. When the wedge is properly fitted, the play will disappear and you can glue it to the base to make the adjustment permanent. **FM**



MORE TIPS FOR GETTING MORE ENJOYMENT FROM YOUR SHOP

Try to avoid the temptation to hang a lot of tools, such as spring clamps or wrenches, from one nail. Although it may save space, the tool you want always seems nearest the wall. The space saved may cause some aggravation and usually isn't worth it.

Once your shop is organized and everything is in place, make a special effort to keep it that way. Allow time for cleanup after each work session. I find myself more eager to get back to my projects when I know everything is in order. On the other hand, if I leave the

shop or project in a mess, I am less anxious to get back to the job.

If you have youngsters, or particularly a teen-age son with an interest in your shop, keeping it orderly will encourage a tool's return to its proper place. It doesn't work like magic, but it helps.

Lumber, pipe, panels and rarely used cutting jigs are best stored high up and out of the way. Ceiling joists or collar beams are usually exposed in a garage workshop and these make instant racks for this purpose. Remember to store large items in a way that allows easy

retrieval. Trying to move heavy objects about while working over your head is an easy way to injure your back.

An organized shop is a safe shop, but remember that your shop is only as safe as you are. Power tools make work more enjoyable, but they require extra attention when in use. Always keep safety glasses near your power tools as a reminder to use them.

After my initial organization of the shop, I wanted to change my original plan. Don't hesitate to refine your plan through shop use. —J.H.

New electronics for fun

Now a little black box can navigate a small pleasure craft like a big steamship.

by Bill McKeown
BOATING EDITOR

Just as a rocky cape rises through the evening dusk and a string of barges rounding it heads your way, fog suddenly settles in. That's trouble, and you sense the meaning of "being in the soup."

But this time, if your boat is well-equipped, you flip a few switches. Electronic dials, screens and even voices show and tell you where you are, which way those barges are headed, the miles between you and that rocky shore, and the depth of water under you for maneuvering. If necessary, you might also tune in the printout of a weather map to show any storms on the way, talk by radio with the weather bureau, Coast Guard or anyone else with a

telephone ashore, and ask your navigation instruments the time and distance from your last checkpoint and your speed over the bottom, plus headings and times to your final landfall. One gadget, in fact, reads out the minutes and seconds the next U.S. Navy Transit satellite will pass overhead near enough for a fix.

Most of these modern wonders were first developed for big commercial craft. Until recently, they used radio tubes instead of transistors, needed a lot of wattage, were heavy and bulky and cost a bundle. Now solid-state design has reduced size and current requirements. It's helped make possible compact shock- and water-resistant units. Best of all, while the devices have become much more sophisticated, they have also grown easier to use. Even an average pleasure-boat skipper can now operate a sonar depth sounder, loran location finder or radar scanner. Eventually, the bigger market may help volume pro-

duction bring the high prices down.

Today, a fishing skiff could easily mount electronic gear equal to the cost of the boat. Prices for the equipment have not kept pace with inflation, but it's estimated that today's \$100,000 sports fisherman is likely to be ordered with an additional \$25,000 in electronic aids. Though pleasure boatmen have powered and sailed for many years without the help of this new exotic gadgetry, they're learning that the latest gear can add much safety and comfort to the sport.

Depth finders

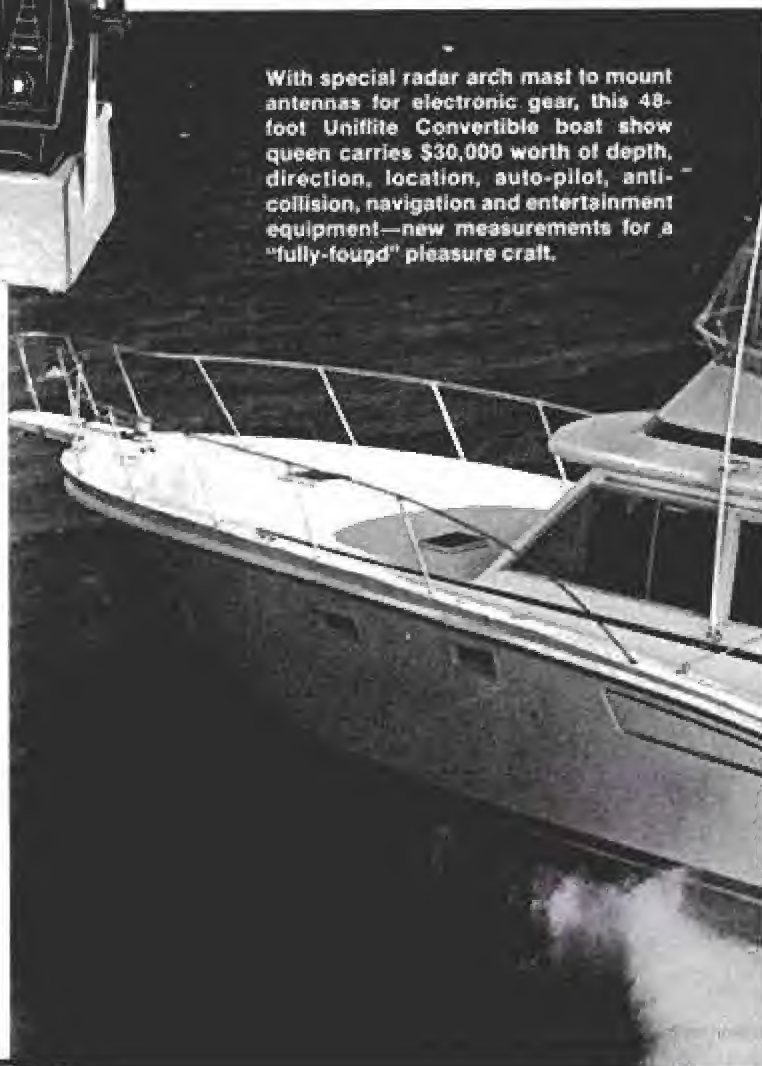
First of the electronic inventions to go afloat in large numbers, the flashing sonar that can measure water depth and pinpoint fish schools in between is still the popularity leader. When Raytheon created the original Fathometer, it was the outgrowth of research to give early warning of icebergs, but was found to bounce back signals from the bottom and from submarines, as well. Lowrance created the post-World War II boom in depth finders

Easy operation has been designed into newest units. Separate gimbaled power pack (right) simplifies moving Lowrance LFP-160 depth and fish finder from boat to boat. Wesmar's DC-710 compass (below) reads heading in digits.



With special radar arch mast to mount antennas for electronic gear, this 48-foot Uniflite Convertible boat show queen carries \$30,000 worth of depth, direction, location, auto-pilot, anti-collision, navigation and entertainment equipment—new measurements for a "fully-fouged" pleasure craft.

Satellite navigation with .1-mile steamship accuracy has been miniaturized with the Magnavox MX 2102 for small-craft use.



boating

with its little, portable, battery-powered Fish Lo-K-Tor that is still available.

Now, Lowrance and others also supply a wide variety of instruments. They range from the small rotating-flasher and digital-readout units to expensive graph recorders with gray-line and white-line charts, plus models that can sound alarms if the water gets too shallow or an anchored boat starts to drift into a deeper channel. Most elaborate are finders that record the bottom on a TV screen, zoom in on details at selected levels, tape-record readings for later playback, and even show results from a scanning transducer that can be aimed or rotated like an underwater radar. Wesmar makes one of these.

Depth-finder prices run from about \$70 for Heathkit units up to nearly \$7,000 for some of the Wesmar scanners by Western Marine—a long way from a \$4.95 lead line.

Instrumentation

Dials that register engine rpm, pressures, temperatures, distance

(Please turn to page 219)

Dual depth readings from a kit



Digital depth readings from 2 to 499 feet, plus five settings for visual and audible alarms, are features of Heathkit's newest Depth Sounder. Available as a kit for home assembly, the device offers remote readout stations, with alarms.

Combine lower cost with a high level of personal satisfaction—that's the bonus payoff for a kit builder. Heath Co., Benton Harbor, Mich. 49022, is an old how-to hand at producing new electronic aids for afloat and ashore.

Latest are a Digital Depth Sounder, MI-2916-1, and Remote Readout, MI-2917, that come with the necessary transducer at nearly half the cost of assembled units of similar quality. The Sounder is \$169.95 with a thru-hull transducer, \$159.95 with a transom mount, or \$179.95 with a flush mount.

The remote readout station (MI-2917, \$119.95) comes with a 25-foot cable, looks just like the base-station sounder, and can be set independently for alarm and depth settings. This means that the helm-position unit, with dial settings for warning light and audible alarms at 2, 4, 10, 20 or 40 feet, can be set to alert a skipper at a 10-foot depth underway.

Meanwhile, when you're moored for the night, the deck alarm can be turned off and

the remote next to a bunk can be programmed to warn if the boat drags anchor in shallows of 4-foot depth or less, for example.

For sailboats, a new flush-mount remote dial can also give readings to 500 feet, plus warnings set on the base unit.

To test the device once it was assembled, we tried it out in both a bass boat and an inflatable. Even with an undersized 12-volt battery in the kayak, both units gave dependable readings. When permanently installed, the sounders can make a keel offset allowance of up to seven feet of keel depth. This can be subtracted so that water-depth measurement starts at zero right under the keel, instead of near the waterline and gives a true reading of the water available.

No knowledge of electronics is necessary to build the sounders, or the direction finders, weather monitors and graph recorders Heath supplies for sailors. Just follow instructions patiently for the fun of achievement.

Around an analog dial giving wind direction, four liquid-crystal digital displays on the British-built Mariner Micro-5 show water depth, miles traveled, water speed and wind speed on 6-inch-diameter instrument.



Newest accessory for Texas Instruments' 9000 Loran C (right) is TI 9930 Speech Option which tells helmsman eight readings.



Bunny toy box that will delight your youngsters

Imagine the look on your toddler's face when there's an Easter Bunny—with babies—waiting and filled with goodies.

by Harry Wicks
HOME AND SHOP EDITOR

This project is undeniably for your little ones, but you'll get a big kick out of building and giving it. The Momma bunny is, in reality, a toy box that will serve year-round as the place to keep a toddler's games and toys corralled. Trailing behind are the mini-rabbits which stand double duty: On Easter morning, these can be filled to the brim to serve as Easter baskets. Once the goodies are gone, the baskets become full-time pull-toys for little ones.

We have created a clever rope arrangement whereby the toys can either be played with individually, or linked together so that the little ones trail the Momma when she is pulled along on her casters.

You don't have to be an artist to build and paint the bunny toys. The shapes for all are shown on grids so you can duplicate them. After the boxes are assembled, they can be

(Please turn to page 191)



Whimsical toy box is on casters; pull-toy bunnies roll, too. See text for how cords fasten (above).

Design by C.J. Castelberry; construction by the author; PM photos by Harry Hartman; styling by Nina Kanter; stuffed animals and dolls by F.A.O. Schwarz, 745 5th Ave., New York, N.Y. 10022

TECH FRONT LINES

Magnetic gun blasts old limits for muzzle speed

Researchers call it a "railgun," a curiously odd horse-and-buggy name for a magnetic device that might someday replace conventional gunpowder weapons.

The electrically powered prototypes use roughly the same principles Japanese and German scientists are exploring to lift and propel trains at hundreds of miles an hour (see *Beyond the Bullet: Japan's New Train Shoots for More Speed*, page 95, Apr. '80). Long before these sleek vehicles began flying over magnetic tracks, scientists dreamed of propelling bullets with some sort of force field. Today, experimental railguns have surpassed the headiest dreams and raised new possibilities: hurling objects into space without rockets, or knocking out enemy tanks with ammunition the size of checkerpieces.

Behind each of these feats is immense speed—at least an order of magnitude higher than projectile speeds of conventional weaponry. Currently, tank shells can be fired with a muzzle velocity of more than a mile per second. Speeds 10 times as high are easily within reach of existing prototype railguns.

How they work

All of these guns, Australian, American or Russian, have certain elements in common.

Look inside a typical railgun before it's fired: To begin with, it has two parallel rails (hence the name) of a conducting material such as copper. A portion of one of the strips of metal is coated with a layer of explosive.

Between the rails, in front of this exploding section, the projectile sits like a train stopped between stations. Experiments carried out jointly at the Los Alamos

National Scientific Laboratory and at the Lawrence Livermore National Laboratory have used plastic cubes as projectiles. Attached to the rear of the cube is a shock absorber, and, behind that, a thin metallic element called an armature, intended to vaporize when a large electrical current flows through it. Finally, a railgun has a power source capable of delivering a jolt of current to set up an electromagnetic field about the two rails.

When researchers fire the railgun, the capacitor bank delivers a surge of current to the rails, creating a magnetic field at the base of the gun. A detonator ignites the explosive on one rail, forcing it against the other behind the projectile, collapsing part of the track and compressing and strengthening the magnetic flux. Because the projectile is made of a nonconductor, the only path for the electric current is through the metallic fuse at the back of the plastic. The fuse then vaporizes into a plasma—a gaseous conductor. Current flowing through this plasma interacts with the magnetic field. The result is a powerful thrust pushing on the plasma. This electromagnetic force—which travels

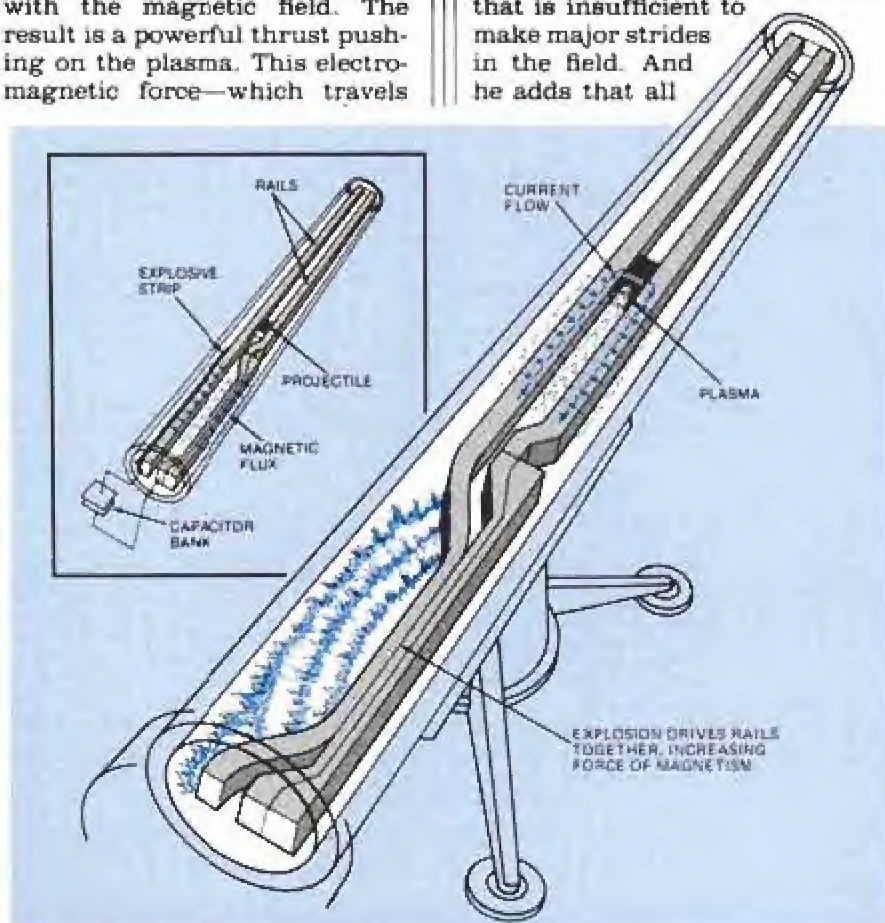
the length of the gun—is so strong that a projectile can be accelerated to hypersonic speeds in about three feet.

Researchers have made no attempt to streamline plastic cubes to reduce aerodynamic drag; the pea-sized projectile we examined was shaped like a mushroom, its face rounded and blackened during firing. Still, in an open, large-bore accelerator, speeds to about Mach 1 have been attained. And in small-bore accelerators, enclosed in a cylinder with the air

MILITARY

removed, scientists are able to get projectile speeds of up to 10 miles per second, fast enough to travel from New York to Los Angeles in five minutes.

Ron Hawke, program manager at the Livermore Laboratory, tells PM that the total American budget for railgun accelerators for both Los Alamos and Livermore is on the order of one million dollars annually, an amount that is insufficient to make major strides in the field. And he adds that all



Current in plasma interacts with magnetic field to propel the projectile.

the answers aren't in yet as to what materials to use or how to recycle a railgun. Once one rail has been mashed against the other by an explosion, the gun can't be reused for another firing. But the potential of the railgun makes all the efforts needed to perfect it worthwhile.

Energy source

Railguns have the capability to propel an object into an Earth orbit. They might also provide one way of achieving controlled nuclear fusion. The projectile would impact a deuterium-tritium pellet at speeds of about 100 kilometers per second, releasing heat that could be converted to electricity.

On the battlefield, projectiles from railguns might penetrate the thickest armor. Here's a paper exercise to prove it. A modern 120-mm tank shell weighs about 45 pounds and has a muzzle velocity of about 4,500 feet per second. This results in a kinetic energy of about 14 million foot-pounds per second. How would that compare with a railgun pellet weighing 10 grams (3¼ ounces) traveling at 150 kilometers per second? The little pellet, about the weight of a business letter, would have a kinetic energy of about 83 million foot-pounds per second, or about six times as much as a powerful tank gun.

Another proposed use is to fire a projectile into a larger body to simulate a meteor striking a moon or planet.

These plans for peacetime use of railguns are several steps beyond the dreams of German scientists who tried to build a working model during World War II. Their device disintegrated, but the principle was revived many years later by the Australians. Based on the work done Down Under, the United States moved into the field. Research is still basic, but the potential is stunning.

In all likelihood, the 21st century will see a generation of tracked vehicles hauling railguns. Much of the weight of these weapons will come from the large electricity sources used to propel small, powderless pellets with many times the killing power of any shell in existence today.

AVIATION

Solar plane soars

Dr. Paul B. MacCready Jr.'s *Solar Challenger* (Tech Front Lines, page 114, Oct. '80) made its maiden flight over California, then winged above the Arizona desert in tests of up to 14 miles—all powered by solar energy striking photovoltaic cells. A radar-like turbulence detector (below) yielded data on flying conditions for pilot Janice Brown.

MacCready and his team are aiming for a June 21 flight from Paris to London.



Turbulence detector emits sound, "reads" echoes to profile breezes.



Challenger flies over California.

FM photos © Don Monice



Janice Brown piloted solar-powered aircraft in flights of up to 14 miles.

ENERGY

After the flood, town goes solar

Since when does a devastating flood leave money-saving solar benefits in its wake?

Since the April 1978 Kickapoo River flood nearly wiped out tiny (population: 514) Soldiers Grove in southwestern Wisconsin. Instead of seeking funds to restore structures and build the usual dams and dikes, the village fathers proposed to rebuild the commercial sector on ground above the flood plain. And they instituted zoning regulations requiring every building to supply at least 50 percent of its heat by solar energy.

The result has been the nucleus of a passive solar village. Why passive? Because townspeople discovered quickly that passive solar doesn't drive up construction costs. For example, the IGA grocery store was constructed at \$26 per square foot—less expensive than a comparably sized, conventionally built store.

The town's action may signal a movement toward the use of solar energy on a community basis. "I know of at least five towns with the explicit goal of incorporating solar energy into every existing and new structure," says Frank DeSerio, director, Solar Cities and Towns Program, Department of Energy. "And that may be a small percentage of what's really happening."

Six commercial buildings have been completed in Soldiers Grove, with approximately 19 more to come. Completion date is April 1982. Has passive solar been successful?

Refrigeration heat

"The IGA store, which also captures and reuses waste heat from refrigeration systems, has not turned on its furnace since July," says Ron Swiggum, director, Community Development, as of mid-winter. "The other buildings are gathering between 70 and 80 percent of their heat from passive solar energy."

The main source of collected solar heat is a south-facing glazed-roof attic on each building. Heat buildup in the attic space is moved by fans into the

heating system of the building.

The few north-facing windows buffet cold with triple glazing. Super insulation wraps all the walls and ceilings: 12 inches for walls (R-38) and 24 inches in the ceilings (R-72). Entries are air-locked.

Last summer, on 95° days, completed buildings never rose above 75° inside. Natural cooling was the result of "thermal chimneys"—air escaping from heated attics pulled cooler air into lower floors.

Solar zoning covers only commercial buildings under the program, partially funded by the Department of Housing and Urban Development. Yet, success in the commercial sector and pressure from the Community Development group has inspired many villagers to retrofit their homes for solar energy.

On higher ground, near the site of the stores, land is eyed by those who want to build "solar" from the ground up. "We got a letter from a lady in Massachusetts who wanted to build a retirement home here," says Swiggum.

Swiggum expects to build a new home on that land. Will his house be built to passive solar standards? "You bet it will," he says. "I'm a believer."

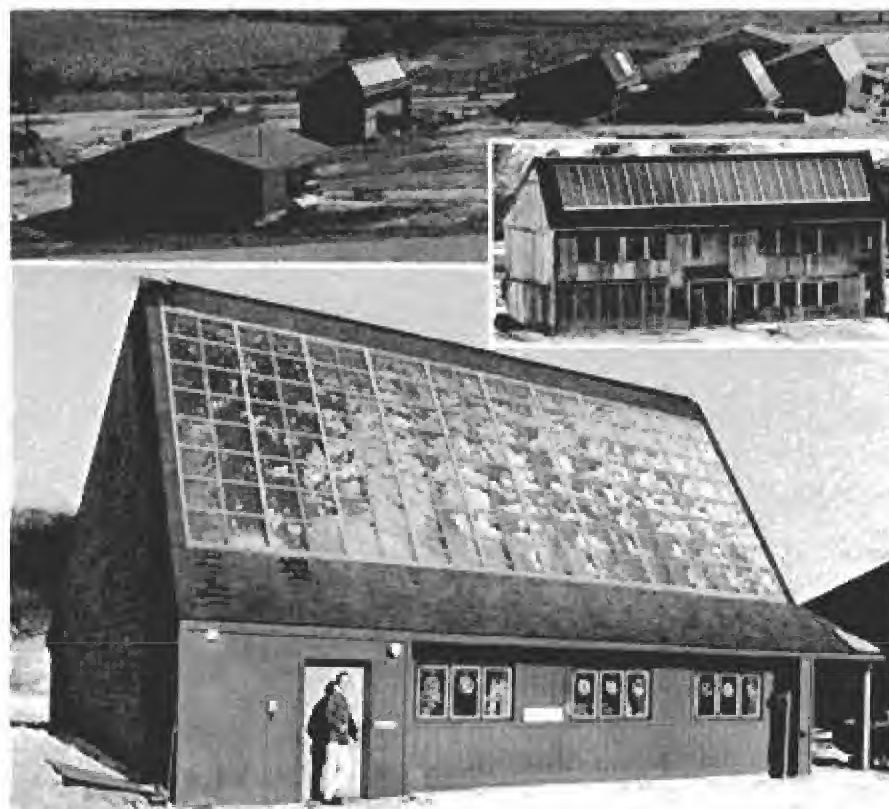
Ten-cent wind power

What's the cheapest source of alternative (nonfossil) energy in southern California? Wind, according to Southern California Edison Co., which recently activated a three-bladed wind generator eight miles northwest of Palm Springs.

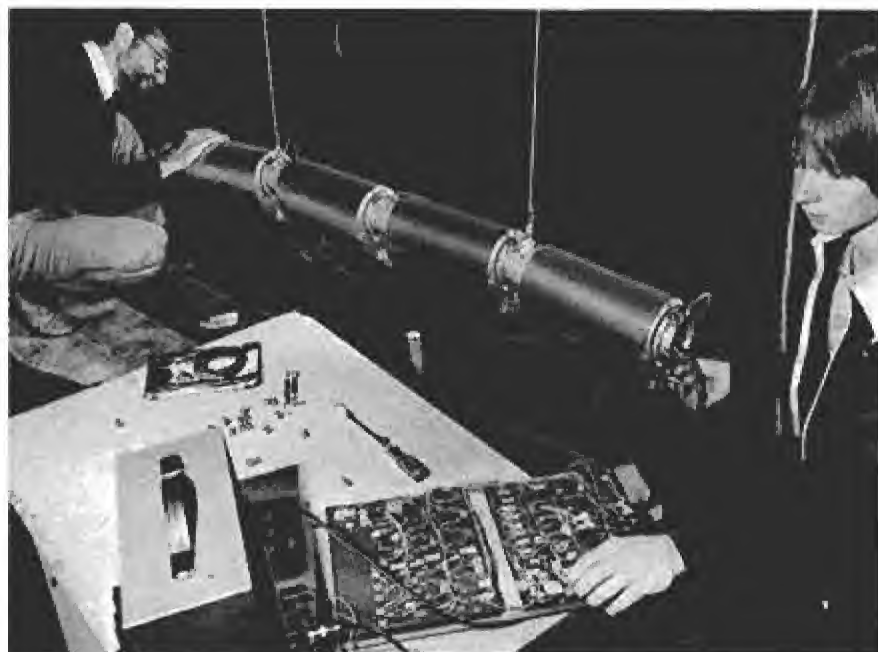
The cost, 10 to 13 cents per kilowatt-hour, doesn't sound cheap. But the utility asserts that this price is less than it would cost to produce electricity from nuclear, geothermal or solar photovoltaic energy sources.

Moreover, the company expects the cost of fossil-fuel-derived electricity to surpass that for wind in fewer years than most of us anticipate. However, a utility spokesman said that no one could predict when fossil-fuel prices would rise enough to make wind fully competitive.

The existing wind machine, which measures 191 feet from



The new Soldiers Grove: Residents stonewall against escalating fuel costs.



Edinburgh University research team plans to draw energy from ocean waves using "nodding ducks," cylinders flattened on one side (see model

above). Gyroscopes inside each "duck" stay level, push against hydraulic pumps as cylinders bob. Pumping generates electric power.

ground to blade tip, is the first of many planned for construction during this decade. When completed, wind generators of various designs are expected to produce 120,000 kilowatts of power.

Southern California Edison was one of the first power companies to tell homeowner/customers how they could earn money selling home-generated power back to the utility.



Goodyear researcher tests soles made of U.S.-grown guayule shrub (foreground) in bid to cut rubber imports. Energy bonus: Shrub waste serves as steam-boiler fuel.

Wood gas fires boiler

A gas extracted from oxygen-starved combustion of wood chips is fueling a 19,000-pound-per-hour steam boiler at the Northwest Regional Hospital in Rome, Ga. A retrofit to existing natural-gas fired equipment, the gasifier is believed to be the largest installation of its kind.

Every hour, 3.1 tons of wood chips (cut mainly from waste forest products) are poured into the 10-foot-diameter, 25-foot-tall gasifier. The metal monster develops 25,000,000 B.T.U.s per hour.

This fiery furnace produces a gas, or really a mixture of gases, containing 135 to 155 B.T.U.s per cubic foot. The gas is piped a short distance to the hospital boiler, where it ignites and burns.

Efficiency is high. The process is said to extract 85 to 90 percent of available B.T.U. energy in the wood.

The designer and manufacturer of the system, Applied Engineering Co., Orangeburg, S.C., sees enormous potential in retrofitting commercial heating and airconditioning systems. But the company doesn't believe there is any promise for home heating with wood gas.

INVENTIONS

Trucking cash

Prof. Bert Bach of the State University of New York has invented a little armored truck that can move a guard with money or other valuables through an opened bank door in complete safety. His satellite truck is carried aboard a large armored truck and deposited on the sidewalk. It has a motor and steering wheel so the guard can drive safely into the bank. (Patent 4,239,447.)

Adjusting to gusts

Floyd S. Cornelison Jr., a psychiatrist in Wilmington, Del., has patented a windmill with cup-shaped blades that collapse when the mill spins too rapidly. During rotation, a weight attached to the cup moves outward, elongating the cup and reducing the area exposed to the wind. (Patent 4,236,504.)



At high speeds, the blades close.

Sleep sitting up

Blocklike equipment that rests on the lap, with a comfortable chin rest on top, enables a traveler to sleep sitting up. The new device (Patent 4,235,472) was invented by Robert Sparks, a pianist, and George Spector, an engineer. The sleeper's arms fit in channels running right and left, and the chin rests on an inflatable rubber balloon. A compartment may be provided to hold food and a tray, or a teddy bear. Spector tells PM he's had a large response to his idea, mostly from reporters, many of whom are likely to fall asleep while sitting at...

AUTOMOTIVE

Prop-in-a-barrel car

The press assembled, the bright lights came on and the video cameras whirled as Cleveland Jim Bede unveiled his latest fantasy: an oversized, white-painted bottle on motorcycle wheels.

It looked like an elongated BD-5, his kit-built airplane, re-suited for ground travel. The car's motive force comes from a ducted fan, a kind of propeller-in-a-barrel, mounted on the car's rear. The car will be marketed as a kit, at about \$8,000. A buying incentive: The prop-driven prototype is said to get more than 100 mpg. And despite problems with Bede's airplane, he expects no lack of customers.

The Bede Aviation Co. is in bankruptcy in Wichita, Kan. There are no engines for the planes—the German engine supplier went out of business. But Bede says he still gets letters offering money from some of the faithful.

Wind up and go

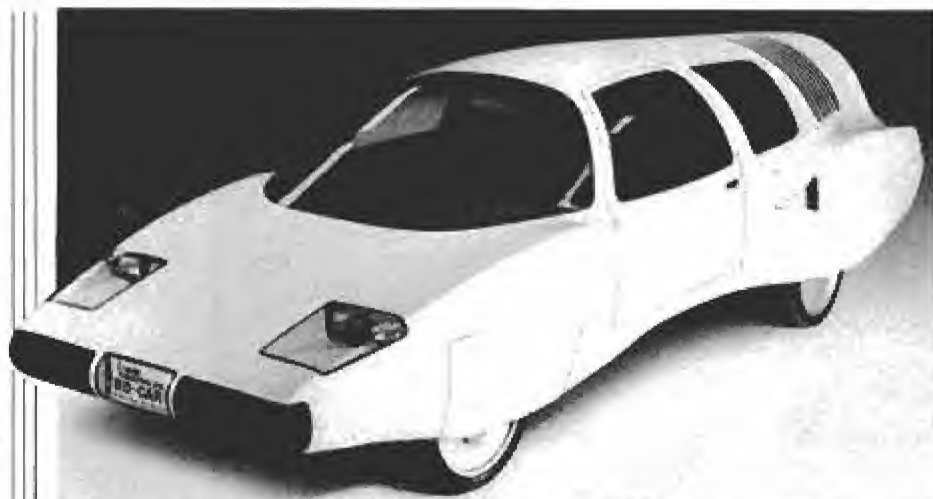
The search for fuel economy has prompted engineers and planners to consider measures which might seem extreme.

We've been told that coasting downhill in an out-of-gear car was dangerous. In some states, it's illegal. But those laws may have to change, if one of the fuel-economy measures currently being studied ever makes it off the drawing board.

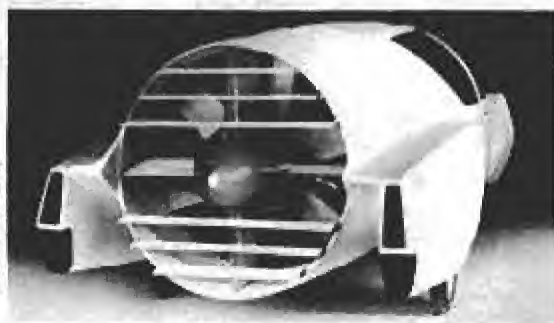
Cadillac's new variable-displacement V8 shuts off four cylinders under light-load conditions, such as going downhill. The next step, we hear, will be to shut the engine off completely—not only when going downhill, but whenever the car comes to a full stop at a light.

The restart system wouldn't use the engine starter. Instead, an elastic device would wind up as the engine runs and unwind to start the engine after a stop.

Sound familiar? The basic idea has been known to model-airplane builders for generations. But the 1980s may be the decade when Detroit discovers the rubber band.



Bede's propeller-driven car reportedly gets 100 mpg and rides on four motorcycle wheels driven by a motorcycle engine. Car uses electric motor to back up. Streamlining is gas-saving feature.



Now, his hopes rest on a fiberglass body atop a box-section aluminum frame, riding on four motorcycle wheels suspended from their original oleo-strut front forks.

The car is driven by a 1,000-cc, 47-hp Kawasaki motorcycle engine mounted behind the car's two seats. It's linked through a 2:1 belt-reduction drive to a Flexodyne coupling. The coupling compensates for a universal problem of both aircraft and automotive shaft-driven propellers: Shafts flutter and vibrate under power and shake themselves (and surrounding portions of the vehicle) to destruction. Bede's coupling drives a steel shaft and six-bladed wooden fan inside a fiberglass shroud.

The designer says he's had the car up to 51.7 mph at the Ohio Transportation Research Center track near Marysville. In three runs, he says he averaged 117.5 mpg.

The testing did not include city driving, which Bede concedes would yield lower mileage. Nor does the research vehicle incorporate bumpers, rear-view mirrors, guard rails in the doors, or tires that can be changed. The

final version of his car will have these, he says. But he doesn't say what mileage it will get with these additions.

Backup engine

The fan-driven car has other obvious difficulties: It can't back up without help (Bede has mounted an electric motor for that), and it's liable to blow hats off pedestrians crossing behind the car as it pulls out from an intersection (although louvers behind the fan direct the airflow upward until the car reaches traveling speed).

On the other hand, the vehicle has a very slippery shape. Bede doesn't list drag coefficient figures for his car. But the prototype has one feature lacking in even the current breed of wind-tunnel-tested Detroit cars: a smooth bottom.

"There is no gimmick here," Bede told the visiting newsmen at his Cleveland introduction. "Just good, sound technology developed by the aerospace industry over the last 20 years, applied to a ground vehicle."

Editor: Gortey Williams III
Contributors: Bill Allen, Tony Assenza, Hans Fantel, Peter Geiger, John Ingereoll, Stacy V. Jones, Murray Rubenstein, Neil Shapiro

ELECTRONICS

Sound brighteners

Scratch any hi-fi fan and you find a would-be recording engineer. When you put on that favorite record of yours, don't you wish you could brighten up that trumpet or maybe put some extra wallop in the bass? Probably you think you could do a better job than the engineer who made the record in the first place.

Maybe you can, and now you can prove it. Some of the latest receivers feature built-in equalizers that let you change the frequency balance of the original recording or broadcast. Such equalizers used to be available only as add-on devices and tended to be expensive. Luckily, in the new receiver/equalizer combos, they add little to the cost of the equipment.

The least expensive of these receiver/equalizers are JVC's new R-S33, a thoughtfully designed piece of gear rated at 40 watts per channel with a list price of \$330, and Fisher's RS2004A, rated at 45 watts per channel and selling for \$350. Both feature a five-band equalizer. Such receivers offer you a range of sonic adjustments—either for listening or taping—that were formerly available only with add-ons.

In effect, the equalizer is an expanded form of tone control. But where ordinary receivers and amplifiers have just two frequency adjustments—treble and bass—these models have five separate slide adjustments. Each slide affects just two octaves of the total frequency range.

Ordinary treble and bass controls affect a broad range of frequencies. This makes it impossi-



Tom Christian of Pitcairn Island provided a link to the outside world with his ham rig—until costs of fuel for the island's generators approached \$200 a barrel. Happy ending: Motorola

la donated a set of photovoltaic panels to power the radio. Now Christian, a descendant of the *Bounty's* noted crewman, is back on the air, powered, this time, by the sun.

ble, for example, to bring out the cello line in an orchestra, which mostly lies in the mid-bass region, without simultaneously boosting the low bass. So if you're pushing the cellos, you'd also make the orchestra sound as if the bass fiddles had suddenly multiplied, grunting heavily at the bottom. The equalizer, by contrast, confines the correction to the exact portion of the frequency range you want to stress (or weaken) without altering anything else.

Bringing back Bix

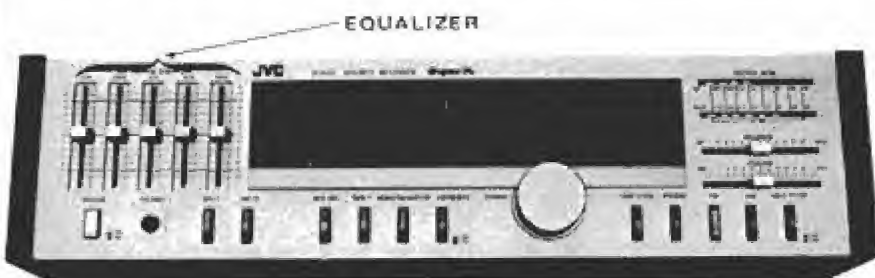
This can be useful in many ways. For example, in a rare vintage recording of jazz trumpeter Bix Beiderbecke, the equalizer enabled us to put some extra sheen in the sound of Bix's horn without bringing up the surface scratch of the old record. That was done by raising the response in the 4,000-Hz region by about 4

decibels and simultaneously cutting everything from about 8,000 Hz on up, where the old record contained nothing but noise anyway.

The immediate result was striking. Bix sounded almost as if he were alive today, even though the record was made more than 40 years ago. We called on this technique to transfer a pile of old jazz records to cassettes, and came up with tape copies that sounded far better than the originals.

Dressing up the sound of old discs isn't the only useful function of the equalizer. In orchestral music, these controls let you "argue" with the conductor. A few judicious slides of a switch and you can reinterpret the classics to your own taste.

Using an equalizer, you can also second-guess the engineers. For example, in some recent recordings, singers seem to be shouting right into your ear. That's because they were miked too closely. Evidently, the engineers were striving for a feeling of intimacy. But they wound up, instead, with the singer breathing down your neck. A slight reduction of the octave between 6,000 and 12,000 Hz, which is accomplished with a slide of the equalizer control switch, effectively gets the singer off your neck.



JVC's R-S33 receiver/equalizer: Bring up the old jazz horn, cut the static.

WORKSHOP MINICOURSE

MORE DRILL ACCESSORIES



Drum sander consists of a rubber cylinder mounted on a mandrel with a $\frac{1}{4}$ -in. shank. The sanding sleeve slips over the drum—frequently with great difficulty.

After drilling holes, the second task you are most likely to use a drill for is sanding. Although accessories that make sanding scrolls and other irregular surfaces easier have been around a while, I am always surprised to learn that many folks aren't aware of them. I have had students (in my adult-education woodworking class) who have never seen a sanding drum—let alone a flap-type sander.

Both are valuable tools in the workshop. And, though they're simple in concept, you do need some practice to obtain sure results. For example, improperly used on an outside curve, a drum sander will damage the scroll's shape.

The sanding sleeves are available in three grades—coarse, medium and fine. With these grades, you can make the roughest cut smooth in minutes.

But I have yet to find a drum whose sleeve is easily changed. Changing sleeves is a nuisance. In fact, I generally cut off the old one to save time. Also, I now keep extras of each diameter in the shop (one each for coarse, medium and fine).

To get the sleeve on the drum, you must first loosen a nut (or screw) on the outboard end to relieve the compression.

Hint: Applying a drop or two of liquid soap on the drum will make the task a bit easier—but too much of it can cause the paper to fail quickly.

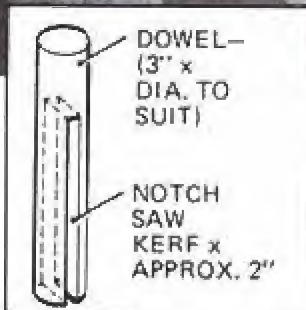
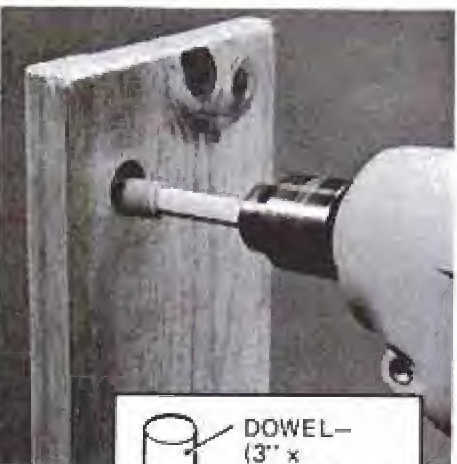
My favorite sanding accessory is the Sand-O-Flex, which is available in two sizes. This is a well-made tool for which you buy inserts. As the extended strips of slashed paper wear down, you simply loosen a nut, rotate the body to advance the paper strips and snip off the worn ends. More about drill (and drill press) sanding in the months ahead. **PM**



On this version, the drum is expanded by tightening a nut. As nut compresses drum, latter expands to hold sleeve securely.



Rugged flap-type sander sports strips of sandpaper around a wheel. This type is excellent for sanding particularly rough scrollwork and other irregular shapes.



A homemade sanding drum lets you do the job in a pinch—especially when you want to sand a tight turn smooth. Pick a dowel that will fit in your drill's chuck.



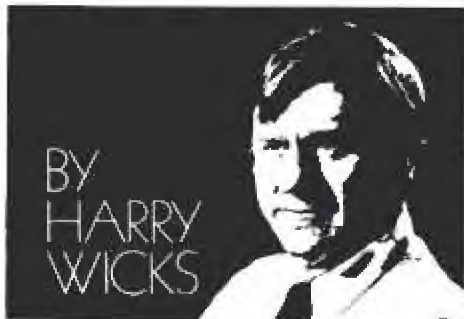
A sanding drum can save hours of arm-wearying hand-sanding when used for internal sanding, as above. Note variety of diameters available. Use the largest size possible to suit the inside curve.



A second version of the flap-type sander features slashed strips, which can be used to sand both the inside and outside cuts of a scroll. The two shown (from Sand-O-Flex) permit you to snip off the worn sandpaper and advance fresh abrasive. The refills keep down the cost of sanding.



Slip a strip of sandpaper on the dowel and wrap it around, against the direction of rotation, as above. Paper tightens around dowel when the drill is turned on.



BY
HARRY
WICKS

'81

HOME IDEAS GUIDE

High interest rates and the cost of a new home these days make improving what you have more desirable than ever. The mood today is to avoid top-heavy mortgages calculated at record-breaking interest rates. On these pages you'll find dozens of ideas to help you improve your home and lifestyle through the use of quality building materials, by selecting from many fine new products—and by sticking with Popular Mechanics' easy-to-do-it-yourself procedures.

Deck and greenhouse you can build

New home-security aids



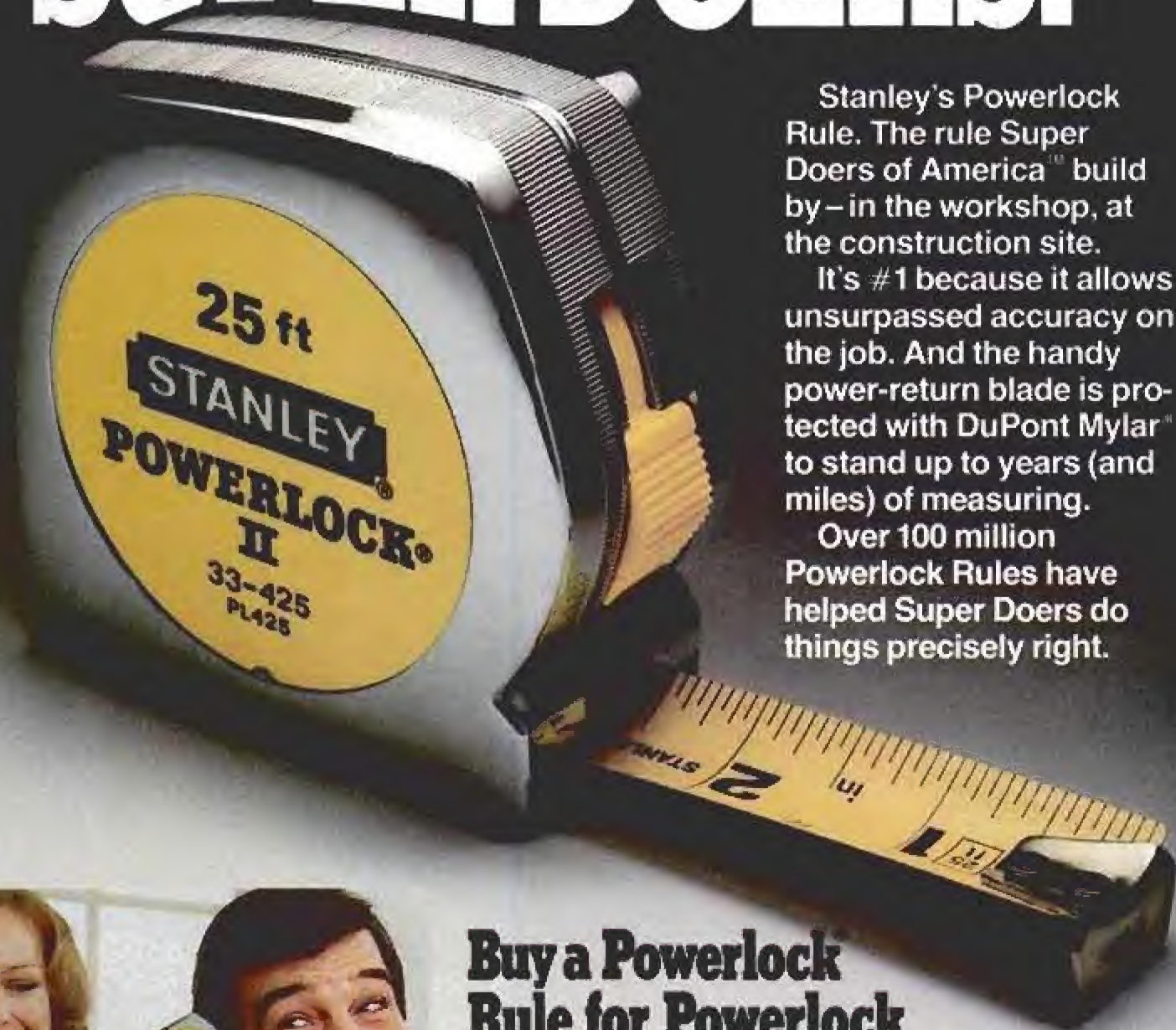
Stackable twin beds



Basement home office

- A master craftsman builds his own home office
- You can add this deck and greenhouse to your home
- New ways to keep thieves out of your house
- Build twin beds that stack up as a dandy couch
- Create this outdoor harvest table with your chain saw
- 5 low-cost energy ideas that work for readers
- 21 new products for your home
- New garage-door protection

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A master craftsman builds his own home office

Commuting is expensive: All it takes to appreciate the merits of a business office in your home is to fill up the car gas tank and see what's left in your wallet. Then recognize that steady advances in electronics and telecommunications are making the home office a viable alternative to the central office.

Consultants, engineers, architects, designers, sales reps and others are discovering that they can work at home with the same efficiency they achieve at central office complexes. Some corporations are actually encouraging establishment of electronically equipped home work centers for use after regular working hours.

The home office design shown here was guided by three objectives:

- Take maximum advantage of today's computer and telecommunications high technology, with the door open to future opportunities in home office productivity offered by the merger of these two expanding fields.
- Provide an environment with lots of visual appeal and creature comforts.
- Hold down the expenditures for energy in this new

It features an electronic-cluster work center in an underground room with a contrasting 18th-century decor.

by David A. Warren

addition to the absolute minimum.

We achieved the latter by building where the climate is mild — underground, where exterior temperature is a nearly constant 55° F., thereby reducing summer cooling and winter heating bills.

Using modern do-it-yourself building materials to simplify construction,

we created a handsome 18th-century decor. Our office is visually appealing and offers dramatic contrast with its electronic-cluster work center.

We established the integrated office work center in the middle of the room, between a Heatilator wood-burning fireplace and a Martin wall-mounted electric space heater. Here is our TRS-80 III with its keyboard, line printer and CRT monitor, as well as Tone Commander's Hold-a-Phone for two lines, ITT's PC 6000 remote answering device and filing cabinets by Hon and Hesco. Here, too, is the all-important telephone link which in the future can integrate our office terminal with computer data bases in major libraries and commercial technical centers with their enormous stores of information.

The TRS-80 III System dramatically increases efficiency



Spacious underground work area below 2½-car garage has a brick fireplace and wood-storage unit with raised tile hearth.

Bifold doors hide drafting table, files and kitchenette. Conduits in the concrete floor feed author's electronic center.

This drafting center with adjustable table and storage cabinet is set immediately behind the electronic work center. Folding doors close off the drafting area from view when it is not in use. The TRS-80 III computer is seen in foreground at left.



Small area for food storage and preparation is an admitted luxury, but it's a good design feature in any active home office—it allows relaxing breaks from the grind. Dehumidifier, a must in basement office, is also in this space.



The primary office contains a word processor with keyboard, line printer and monitor, and telephone equipment and files.



The fireplace was slightly raised to create a pleasant focal point. Arched wood storage bin is in keeping with the overall room decor.

and productivity of a home office, with its word-processing capability and capacity for handling mathematical computations required for a small business. The system's 32K RAM of memory and built-in disc drive, coupled with software tools, enables us to develop forecasts around sophisticated models, sort large files rapidly and still have room to grow with the addition of external disc drives.

We anticipated working long hours at our electronic cluster, so we were particularly careful when selecting a desk chair. We chose the self-adjusting "Vertebra" armless chair which adapts to seating requirements of the individual at work. It has five wheeled supports instead of the usual four, giving it maximum

stability. It's designed to give proper back support in all positions, reducing sitting fatigue during extended work sessions.

Recognizing the long hours and a need for handy refreshments, we equipped our office with a compact kitchen unit made by Acme National Refrigeration. Ideally suited for the small office, it contains a 6-cu.-ft. refrigerator, two-burner electric cooktop, stainless-steel sink, plus countertop and undersink storage—all in a 30-inch-wide modular unit. The refrigerator is especially useful for storing our film inventory.

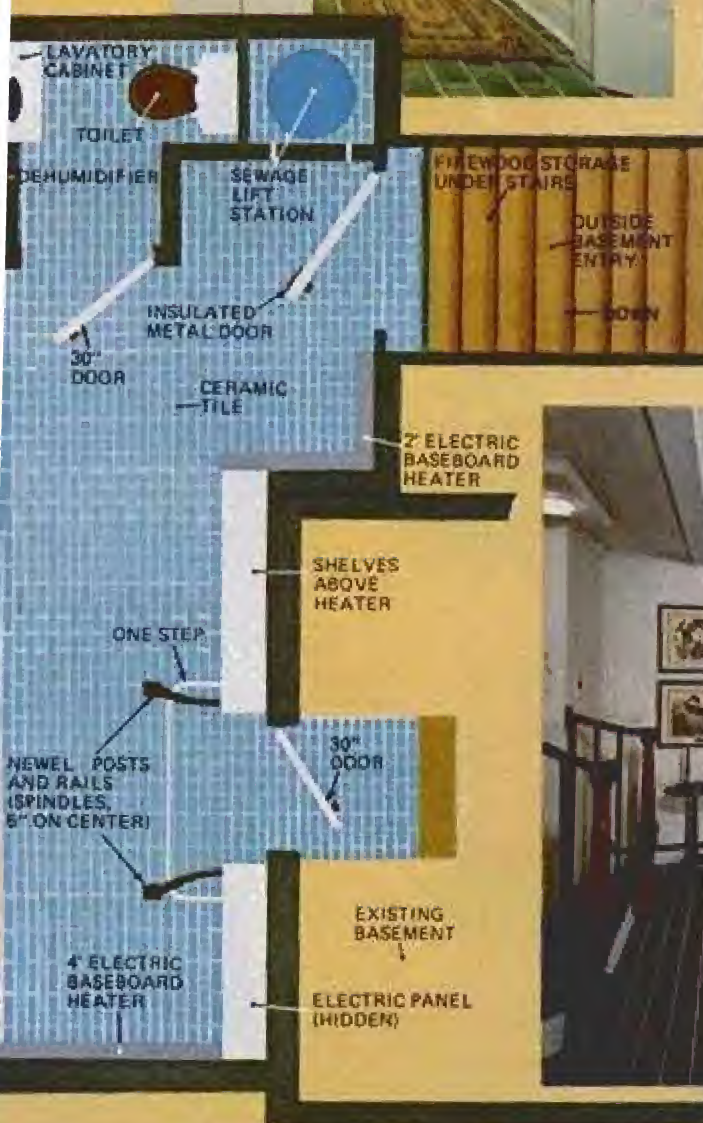
To complete our equipment needs, we obtained a Blu-Ray Colt 200 tabletop whiteprinter that can produce a diazo print 39½ inches wide by any length. This compact unit is only 5

PM photos: Matt Doherty; designers: Virginia Howley; construction: David J. Warren

An attractive half-bath is finished with paneling to match the office. The waste line is routed through a commercial sewage-lift device.



Access to basement office, without disturbing house occupants upstairs, can be accomplished through an outside entrance. A Bilco cellar door was installed outside, and owner custom-built the open stairway. The attractive six-panel insulated steel door at bottom keeps out drafts.



A lighted photo mural behind the leaded-glass panels on the back wall gives the illusion that the office is on the ground floor.

inches high, 11 inches deep and 52 $\frac{1}{4}$ inches long. Depending upon exposure, it can produce prints at a speed of 14 feet per minute.

Behind the work center, our Formatec drafting table with a Vemco V Track No. 4 drafting machine and attached Vemcolite, can be in the modern, nearly vertical attitude for maximum productivity.

Our home office is totally below ground level beneath a 2 $\frac{1}{2}$ -car garage. All interior surfaces—walls, floor and ceiling—are concrete. While summer cooling is a relatively small problem due to the cool earth outside, dehumidification must be considered not only for the underground space, but also be-

cause some electronic equipment has a low tolerance for humidity. We have a large Martin Industries dehumidifier to control humidity. A small hose behind the Wypon baseboard connects it to a floor drain in the bathroom. Wood in the Sykes floor, plus studs, doors and cabinets absorb excess moisture, too.

For convenience and safety, our office has two entrances: one from outside is via a Bilco stairway and Steelcraft door, and the second, from inside the basement of our home, is Masonite's Colonist. To seal around these door frames, we used Great Stuff instant foam insulation, which is handy for caulking hard-to-get-at locations. We also used it to seal around the entire perimeter of the room, where concrete block walls meet the

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A cartridge-actuated hammer is helpful in fastening the threshold to the concrete floor. A steel door secures the exterior entrance. Stairway comes preassembled.



To accent the area, the fireplace is slightly raised on a concrete hearth. The framing extends well beyond the proportions of the fireplace for greater visual drama.



Mortarlike joint material adds finishing touch to the fireplace wall. The mortar and keystone arch give an authentic appearance to the imitation-brick panels.



Insulation $\frac{3}{4}$ -in. thick is glued to the wall between top and bottom furring strips of same thickness. A 2x4 is temporarily nailed to strips until the glue sets.



After drywall was applied over the insulation, paneling adhesive was used to secure the paneling. The deep etching on the panels adds to the room's traditional styling.



Factory-made door comes prehung in jamb. Latter slips into rough opening and is shimmed and nailed in place. This saves hours and makes the job an easy one.

ceiling. The ceiling rests on strips of $\frac{1}{4}$ -in.-thick tempered hardboard to allow for expansion, contraction and flexing without cracking the walls.

There is a third "entrance" in our room—a patio door with leaded-glass panels in front of a lighted photo mural. This door is flanked by bookcases that feature closed storage doors. The lighted door offers general illumination for the room and its simulated view eliminates the closed-in feeling often felt in an underground room.

Electronic work center

We sawed a channel in the floor to carry electrical power and phone lines to the electronic work center. An additional conduit was installed for possible future use for extra lines. If the time comes when even more power or phone connections are needed, we can drop lines down from the hollow ceiling beams. (Ed. Note:

Plans and complete instructions for building the work center/desk, and bookcases in the home office will appear in the May issue.)

On the concrete walls of our underground room, we applied 1x2 furring strips at the floor, ceiling and corner joints. This was done because we needed space through which to run BX cable for power, and we wanted to insulate with $\frac{3}{4}$ -in.-thick foam panels. We also needed a place to attach the following drywall and the paneling selected to give the room its classic 18th-century appearance.

Two aids helped us attach electrical outlet boxes, furring strips and ceiling beams. A power hammer made nailing into concrete fast and easy. We applied Sticky Stuff adhesive to the furring strips and the ceiling-beam nailers prior to nailing them in place.

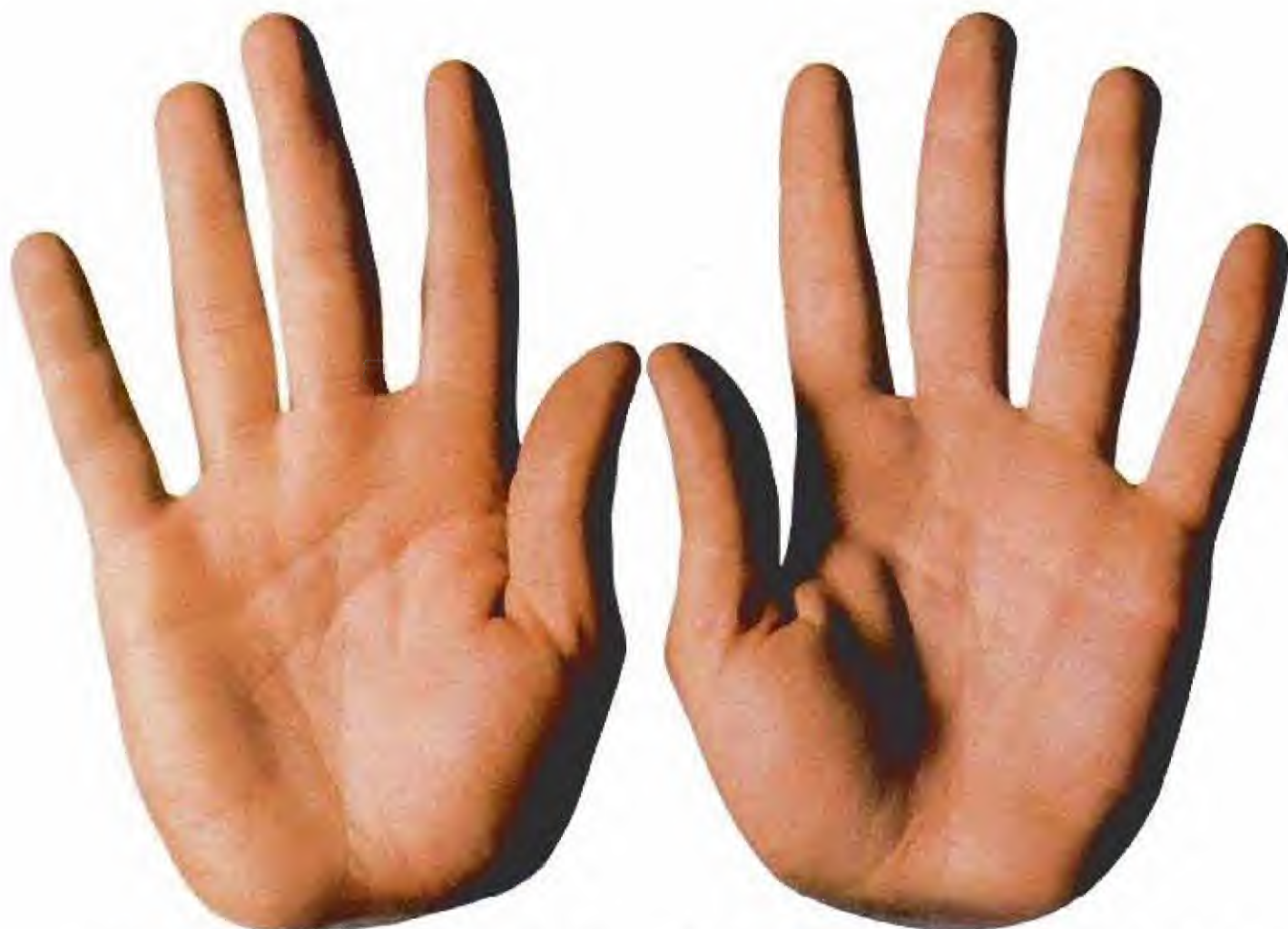
The $\frac{3}{4}$ -in.-thick insulation sheets were cut to fit snugly between the furring strips

and glued. Here it is important to use a water-base mastic that won't dissolve the insulation. After each sheet was placed, a 2x4 was fastened to the top and bottom furring strips to secure the foam until the adhesive set up.

Next, we installed 4x8-ft. sheets of foil-backed drywall. This backing provides a vapor barrier; that's especially important in an underground room. Finally, we installed the hardboard paneling with panel adhesive and color-matched nails.

The paneling chosen requires some advance planning. The embossed-panel design creates 16-in. sections, so each wall must be laid out before the paneling is cut and applied. Otherwise, you might end up with a half-panel at a corner. We used $\frac{1}{4}$ -in. tempered hardboard for fillers on walls where 16-in. panels didn't quite cover. However, before moving to the finished-paneling stage, we installed the

(Please turn to page 141)



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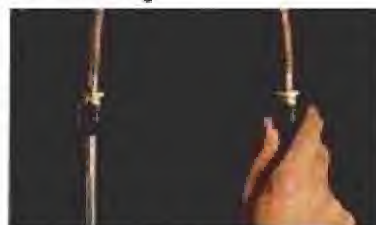
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For a good-looking, low-maintenance finish, glazed ceramic tile was applied to the hearth. Grout that matches the mortar lines of the adjoining brick is applied later.



Oak parquet floor tile is laid to complete the home office. Electrical outlets, a phone jack and an additional conduit for future power additions to the home office are visible.



Urethane-foam reproduction of an 18th-century molding can be tooled as if it were made of soft pine. First prime it; then cut it in an oversize miterbox as shown. Similar molding is used for the baseboard, the casings, on niche surround, and on the mantel that's in the office.

HOME OFFICE

(Continued from page 139)

fireplace and framed out for the closet wall and work space.

Fireplace framing

Framing for the fireplace included a form into which concrete was poured to create a slightly raised hearth. The Heatilator fireplace appears to be energy-efficient, drawing outside air in for combustion and circulating room air through a separate plenum to heat it and return it back into the room. Ducts that do this are carefully wrapped with 6-in.-thick insulation to boost heating efficiency.

Around the face of the hearth we used imitation-brick panels that suit room decor perfectly. This is especially true because the joints are filled with mortar that contrasts with the brick color. The raised hearth was then covered with glazed ceramic tile.

Since our underground office was tightly sealed to conserve energy, we provided ventilation by installing a permanent-type heat exchanger in the wood-storage area adjacent to the fireplace. Fresh outside air is preheated (or precooled) and mixed with the inside air to recover some 70 percent of thermal energy otherwise lost through ventilation.

The finishing touch completing the 18th-century character of the room is the use of faithfully reproduced period baseboard and moldings. We used a wide ceiling cornice molding between the wall and ceiling, and a flat decorative trim around doors and the fireplace wall.

A feature in the 18th-century mood is the parquet flooring—a scaled-down adaptation of the floor that Jefferson designed for his Monticello, Va., home. We applied the laminated-oak parquet directly to the concrete floor using wood parquet-floor mastic.

Another President also contributed to the 18th-century decor: We adapted the newel post and banister at the Lincoln National Home Site in Springfield, Ill., for use at the step-down entrance to the basement.

Overall room illumination is provided by the lighted false entry, two period fixtures on the fireplace wall and a lamp on the electronic work center. Traditional-styled track lighting is well suited to the room's decor and used in work areas beyond the bifold doors.

A sand-finish paint covers the ceiling. All trim is primed and painted white.

The final touch of class is the 18th-century brass doorknob hardware. The heavy colonial rim locks shown are easier to apply than are mortise locks. The lockable inside doors will help to ensure that the space is used exclusively for business purposes.

In planning and building our home office, we felt that the ability to run additional power and telephone lines at a later date was extremely important. To finish the ceiling, for example, the angled cornices not only suit the room decor, but also provide a channel through which power can be brought in. Hollow box beams will allow power cable to cross the room or drop down from the ceiling without being seen.

It is generally believed that the existing network of conventional phone lines, along with new fiber-optic cables, will prove the major carrier of great amounts of computer-stored information.

Surrounded by the wonders of computerization and telecommunications, it is comforting to keep our feet on the firm ground of reality by employing a centuries-old design theme. We think we've successfully mated modern technology in materials and equipment with a decor that says, "relax and enjoy life" while you work productively.

PM

SHOPPING INFORMATION

All materials used in this office are available throughout the United States. For buying information or nearest dealer, write directly to these manufacturers:

Compact kitchen unit, Acme National Sales Co. Inc., 19-26 Hazen St., Astoria, N.Y. 11105; ceramic floor and wall tile, American Olean Tile, Lansdale, Pa. 19446; door hardware, cabinet pulls, desk accessories, Baldwin Hardware Mfg. Corp., 841 Wyomissing Blvd., Reading, Pa. 19603; texture paint, primer and wall paint, Benjamin Moore & Co., Chestnut Ridge Rd., Montvale, N.J. 07645; door and stair stringers, Bilco Co., New Haven, Conn. 06505; Colt 200 diazo machine, Blu-Ray Inc., Essex, Conn. 06426; red oak plywood panels, Columbia Plywood Corp., Box 1780, Klamath Falls, Ore. 97601; Formatec drafting table 10101, Creative Dimensions, 1205 East Lincoln, Naperville, Ind. 46550; photo mural No. 5140, Crown Wallpaper, 88 Ronson Dr., Rexdale, Ont. Remington power hammer, Desa Industries, 25000 South Western Ave., Park Forest, Ill. 60466; Styrofoam-brand T&G insulation, The Dow Chemical Co., 1703 South Saginaw Rd., Midland, Mich. 48640; cement and grout for ceramic tile, H.B. Fuller Co., Construction Products Div., 315 South Hicks Rd., Palestine, Ill. 60067.

Decorative moldings, Fypon Inc., 108 Hill St., Stewartstown, Pa. 17363; 3138 E.P. fireplace, Heatilator, Div. Vega Industries Inc., Mount Pleasant, Iowa 52641; Oak lateral two-drawer file No. HPL 2-2030, Hesco, State Rte. 62, Charlestown, Ind. 47111; steel two-drawer desk file and five-drawer lateral file, The Hon Co., 414 East Third St., Muscatine, Iowa 52761; Great Stuff sealant, Sticky Stuff adhesive, Insta-Foam Products Inc., 2050 North Broadway, Joliet, Ill. 60435; telephone answering and message recorder, ITT, Consumer Specialty Products, 133 Terminal Ave., Clark, N.J. 07066; VENAP-IC-FT office chair, Krueger, Box 8100, Green Bay, Wis. 54308; Lite-Trend fixtures, Halo track lighting, Lighting Products Div., McGraw-Edison, 400 Busse Rd., Elk Grove Village, Ill. 60007; dimmer switches, Lutron Electronics Co. Inc., Coopersburg, Pa. 18036; brick panels, Roxlum mortar, Marite Prod., Dover, Ohio 44622; forced-air wall and electric baseboard heaters, dehumidifier, Martin Industries, Box 128, Florence, Ala. 35630; hardboard paneling, Colonist six-panel door skins, Masonite Corp., 29 North Wacker Dr., Chicago, Ill. 60606; Losanay heat exchanger vent system, Mitsubishi Electric Sales America Inc., 3030 East Victoria St., Compton, Calif. 90221.

Foli-back drywall, National Gypsum Co., Gold Bond Building Products Div., 325 Delaware Ave., Buffalo, N.Y. 14202; Chateau patio door with leaded-glass panels, Peachtree Doors Inc., Box 700, Norcross, Ga. 30071; TRS-60 Model III word processing computer, Radio Shack, Tandy Corp., 1600 1 Tandy Center, Fort Worth, Tex. 76106; prestressed concrete ceiling, Spancrete Industries, 10919 Blue Mound Rd., Milwaukee, Wis. 53226; six-panel insulated steel entry door, Steelcraft Mfg. Co., 9017 Blue Ash Rd., Cincinnati, Ohio 45242; sewage lift station 0255-70F, Stevens Pump Co., 311 North Desplaines St., Chicago, Ill. 60606; Jefferson parquet wood flooring, Sykes Flooring Products, Box 999, Warren, Ark. 71671; Hold-a-phone II two-line hold, Tone Commander Systems Inc., 4320 150th Ave. N.E., Redmond, Wash. 98052; Model 4 V-track drafting machine with Vemcofile, Vemco Corp., 768 South Fair Oaks Ave., Pasadena, Calif. 91105; miscellaneous building materials, construction adviser, Wickes Lumber, 515 North Washington Ave., Saginaw, Mich. 48607.

You can add this deck and greenhouse to your home

Build either one or both—they were designed for PM's Vacation House, but they'll look just as good on yours.

by Harry Wicks HOME AND SHOP EDITOR

'81 HOME IDEAS GUIDE

During the planning sessions for the PM Vacation House (see page 106) all participants agreed that the most important do-it-yourself projects would be the add-on deck and the solar greenhouse. The design challenge given to Gilbert Benson was to create a pair of structures that would immediately blend with and beautify the Wick Building Systems' factory-built home. At the same time, the designs had to be flexible enough so that those readers who wanted to build the deck or greenhouse—but not the home—could utilize the ideas.

Because our home is on a gently sloped site, our deck is a multilevel one. The site choice was deliberate because



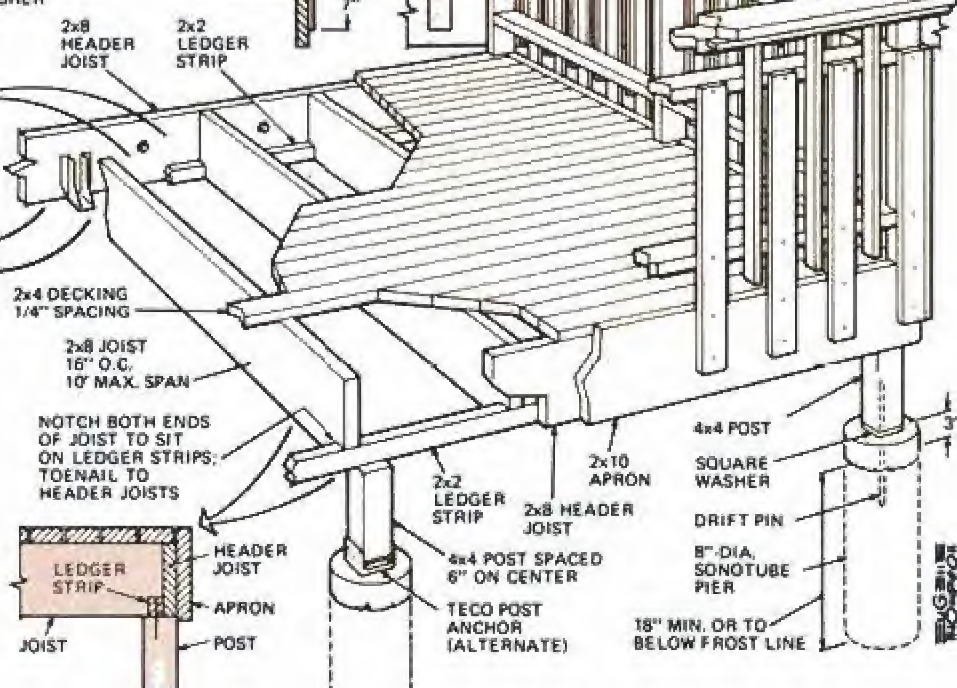
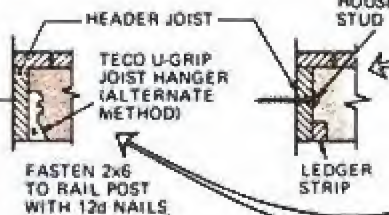
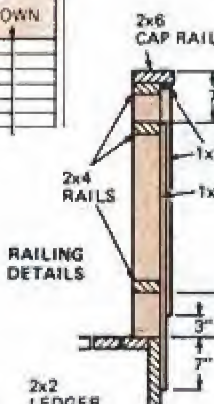
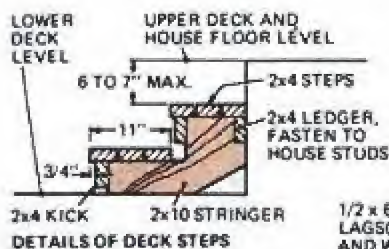
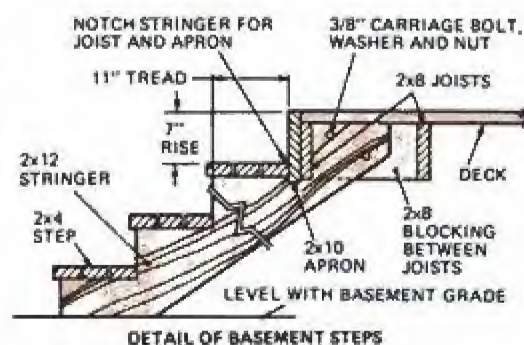
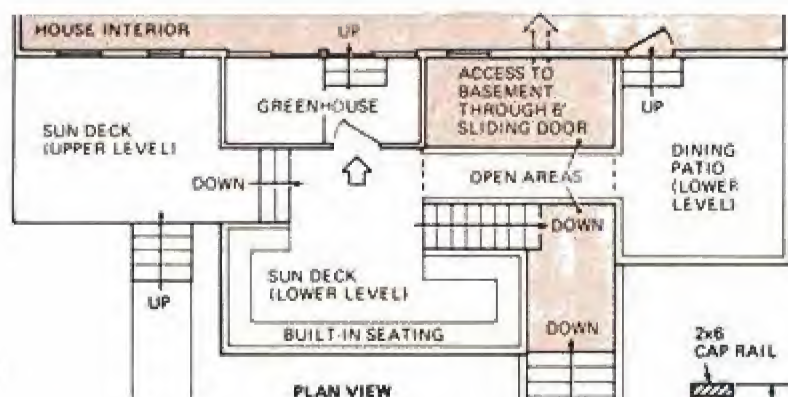
we wanted to use sliding doors to the basement workshop area. However, if your site is flat, you can still use many of the deck ideas by modifying dimensions. On a flat site, for example, the chances are good that rather than give up a wide entrance to the basement, you would install an outside cellar entrance, such as the Bilco door product.

Strength of the structural members is

PM photos: Gary Bradt
Greenhouse and deck concept: Gilbert Benson, Armstrong World Industries Inc.
Construction details: Donny Russell, Buddy's Homes, Eugene Thompson and Harry Wicks
Materials: California Redwood Assn., 1 Lombard St., San Francisco, Calif. 94111
Styling: Debra Seaburg, ASID; Armstrong
Deck furniture: J. Hancock Furniture Mfg. Co., Box 209, San Diego, Calif. 92112
Barbecue: Charmglow Prod., Box 127, Bristol, Wis. 53104.



For charm and elegance, you can't beat redwood. Both the deck and greenhouse attached to Popular Mechanics' Vacation House were built using this good-looking wood.



particularly important when planning any deck construction. Thus, no joists should be used to span any distance greater than those shown without consulting a qualified engineer or your local building department.

Before construction, you would be wise to check with your building department to learn what the local code requires. In some areas, deck size is determined by how much of the property can be covered by structures. Or, you may be limited by the proximity of the structure to property lines.

Before you check the local code, lay out your deck so that you can work up a fairly accurate plan. Instead of trying to make up your mind by drawing on a piece of paper, take time to lay out the actual deck the way you plan to build it, using mason's line and pointed stakes. This way you can "live" with the proposed deck before building it.

Move deck lines and stakes around until you are satisfied with the area the deck will provide. Then transfer the design to graph paper, scaled $\frac{1}{2}$ in. per

foot. On this, indicate the house wall to which the deck will be attached, as well as windows and doors in that wall. Also, draw in all elements of the deck: benches, planters, stairs and the like.

Bring the drawing and house survey with you when you go to the building department. In some areas you will have to obtain a permit; other municipalities require it only if the deck will be covered by a roof. If such a permit is necessary, you may have to leave the original inked drawing and a photocopy. Be sure you also obtain a few photocopies for your building purposes.

People at the building department can help you with building technology, should you decide to alter the deck design as shown in the drawing. Since joist size is relative to the span of the member, make certain that your deck structural members are not undersized. Too-small joists will give you a deck that bounces or springs when it's walked upon—a sure sign of poor building.

The deck shown is constructed almost entirely of redwood using 4×4 cedar

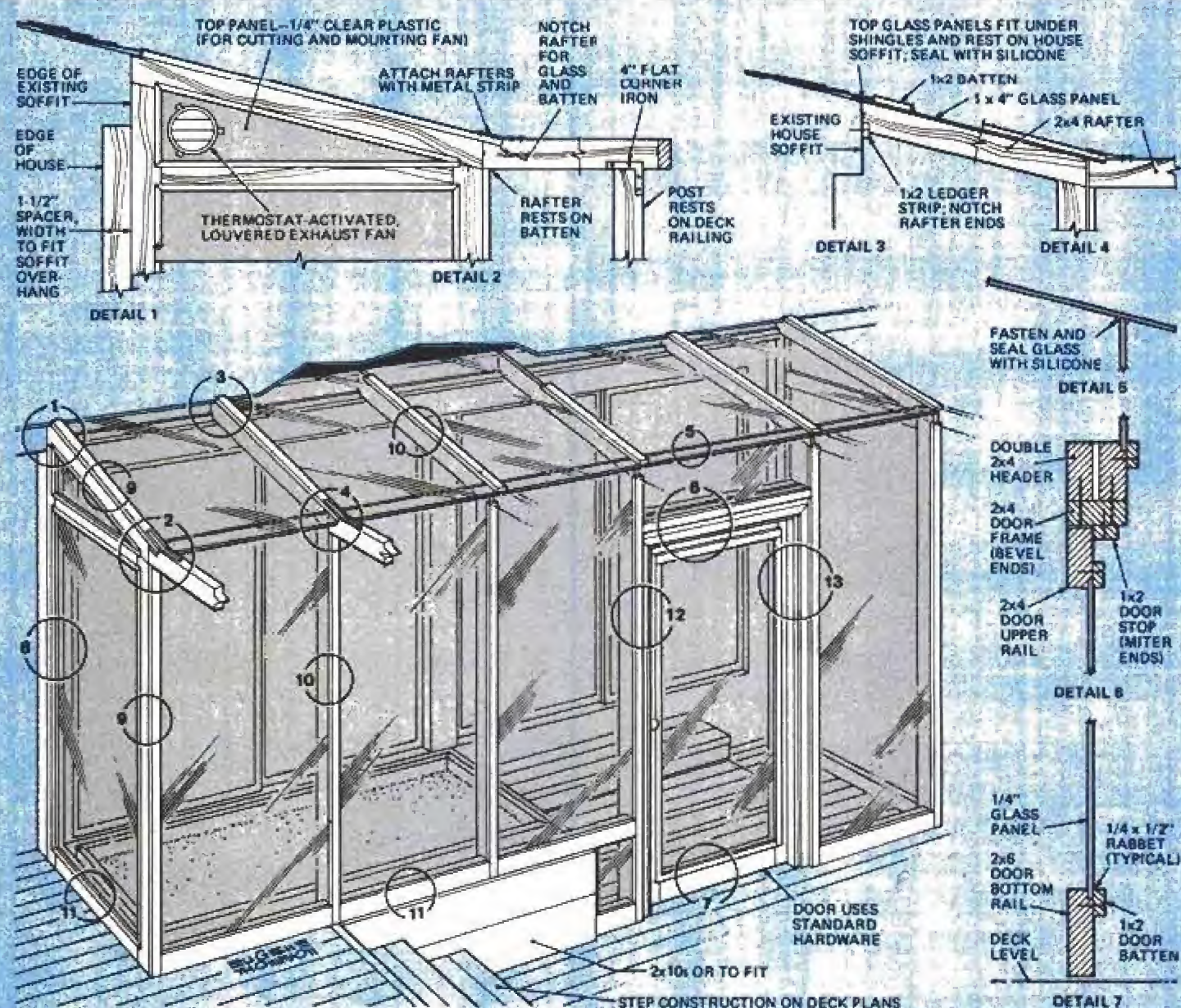
posts on piers. The 2×8 joists (with notched ends) rest on ledger strips face-nailed to header joists. If preferred, you can eliminate the ledger strips and use framing hardware (such as Teco joist hangers) instead.

The seating, railing and steps are assembled on the job site and built into (that is, attached to) the deck.

All wood members in the ground should be of pressure-treated material or be treated on the job with a commercial wood preservative. Any redwood near the ground should be Construction Heart redwood; remaining redwood members can be Construction Heart or Construction Common.

Make certain that you use nonrusting nails and fasteners throughout deck and greenhouse construction. Use either stainless steel, aluminum alloy or best-quality, hot-dipped, galvanized metal throughout. Otherwise, you will be certain to have ugly rust-stain streaks wherever there is a fastener. Use 16d common nails for all framing.

The deck shown was finished with an



exterior latex stain, which is opaque. You could, if desired, leave the redwood as is and permit it to age to a handsome silver-gray patina.

Installing the railing

The railing's contemporary design has just a hint of the Swiss chalet about it. Yet, a careful look at the drawing on page 143 reveals that there is no tricky, complicated construction involved. But, there is an easier way to get it built.

Start at the corners. Install a 36-in. length of 4x4 at each corner, flush with the aprons in both planes. Using your spirit level, make certain that the post is also plumb in both planes when it sits on the deck. If it isn't, insert wedge-shaped shims to make it so. When the post is attached, measure up 30 in., mark and cut the post off at that elevation.

Each post should be anchored to the deck with a minimum of four 16d common nails driven at an angle (toenailed). Use your electric drill to bore pilot holes to make the nailing easier through the post (do not bore into the deck).

Next, the rails can be installed between the posts. Check with your spirit level, then toenail rails to posts. Use 16d nails. The top rail rests on top of the posts, and when the 2x6 cap rail is added it means that your railing height should be about 33 in. above the deck.

The balusters are of 1x4 redwood and these can be fastened to the rails with 12d nails. For the two bottom fasteners—into the apron—which are indicated as dots on the floor plan, use 2½-in. No. 12 galvanized screws. Bore pilot holes and counterbore for these fasteners so that you can conceal the screwheads with dowel plugs cut from scraps of redwood.

About the greenhouse

The most expensive part of building any greenhouse is the glazing. And the PM version is no different. The builder here used ¼-in.-thick sheet acrylic, but you may prefer to install ¼-in. glass instead. The plastic is nonbreakable—a strong consideration if you have youngsters. Its biggest disadvantage is that it

shows scratches—while glass does not.

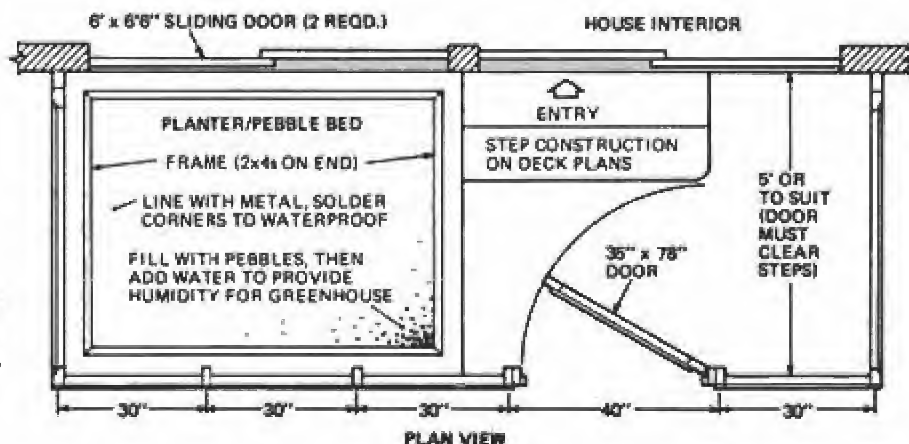
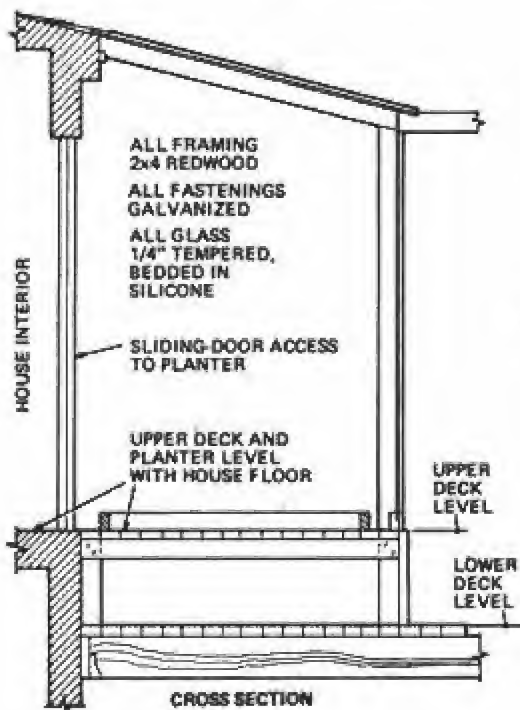
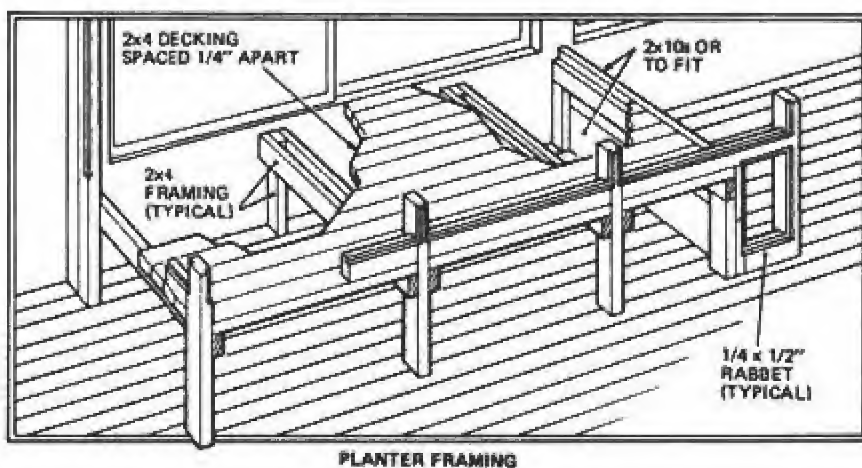
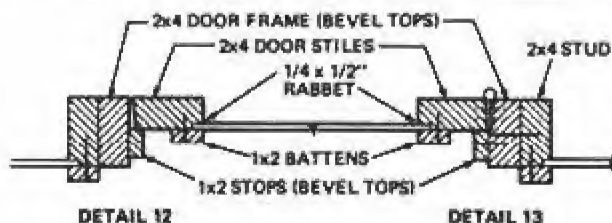
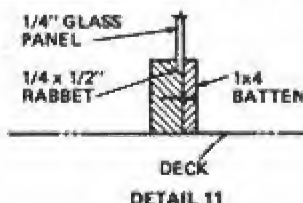
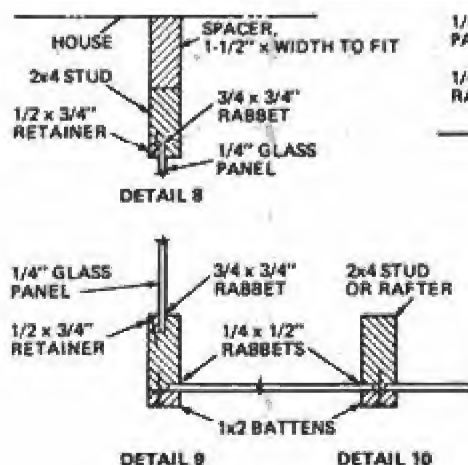
There are some variations from standard building techniques because of the way that the designer tied the structure to the existing house. Study the details carefully. Rafters and studs are rabbeted to receive the glazing, for example, then battens are installed to seal the joints.

In the prototype, a pan is built on the floor inside using 2x4s set on edge. This, in turn, can be filled with either sand or gravel.

The pan must be absolutely waterproof to prevent any moisture damage to the floor below. You can achieve this by using 6-mil polyethylene plastic sheeting. A permanent sheet-metal pan with soldered joints and corners is even better.

Since the greenhouse collects considerable heat when the sun is shining, it must be fitted with a thermostat-controlled exhaust fan. If you fail to install such a fan, the plants inside will be short-lived due to high temperatures. Consider installing a solar blind or shades so that the heat can be "screened out" in the warm months.

PM



IF RISING FUEL COSTS MAKE YOU BLUE, THINK PINK.

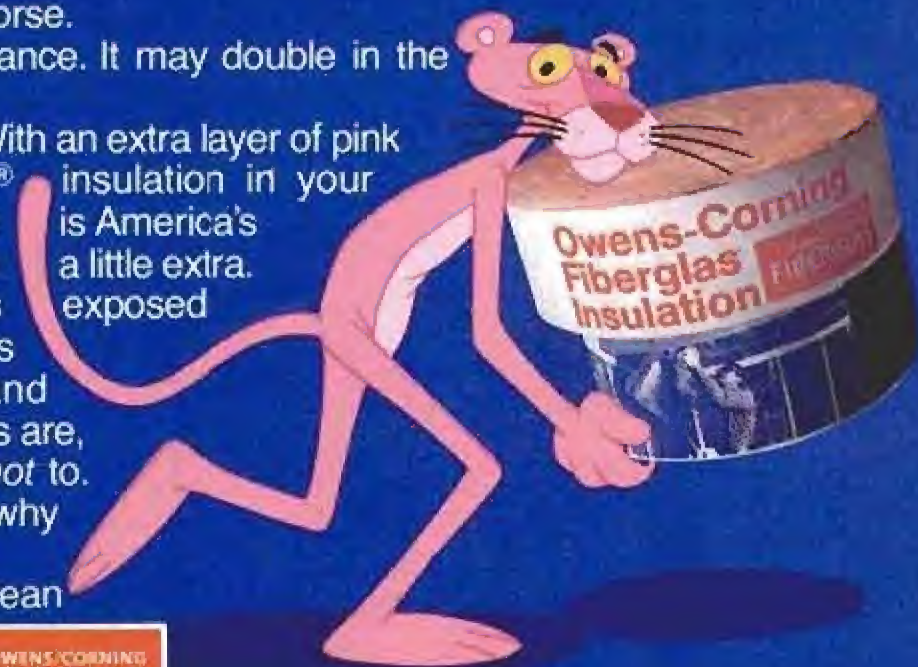
Cheer up, things could get worse.

The cost of fuel, for instance. It may double in the next ten years.*

But you can fight back. With an extra layer of pink Owens-Corning *Fiberglas*® insulation in your attic. Pink Owens-Corning best-selling insulation. Add a little extra.

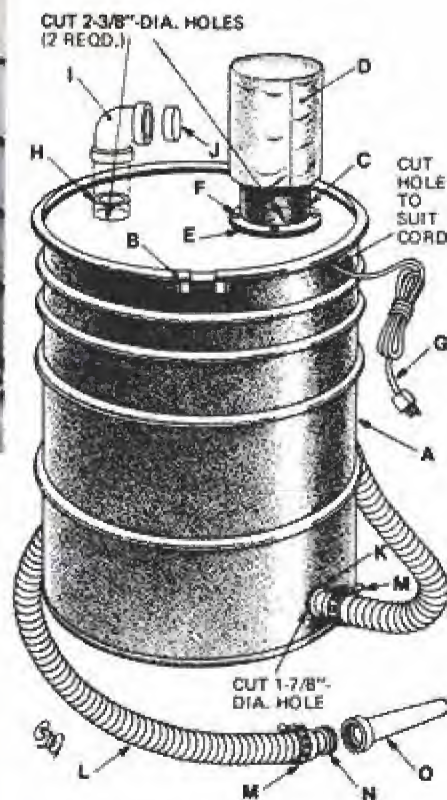
Insulate your attic, walls to heat and cold, and floors over unheated garages and crawl spaces. The way things are, it could be more expensive *not* to.

Savings vary. Find out why in the sellers fact sheet on R-values. Higher R-values mean greater insulating power.





Insulation is blown through house exterior. Paint bucket with hole in bottom (above) serves as a funnel.



MATERIALS LIST—BLOWER

Key	No.	Size and description
A	1	55-gal. drum with removable lid
B	1	clamping ring with rubber gasket (not shown)
C	1	1 1/4-hp shop vacuum-cleaner motor
D	1	dust cover
E	1	rubber gasket to suit
F	4	No. 8-32 sheet-metal screws
G	1	electric motor cord
H	2	2" i.d., 3' PVC pipe (see note in text)
I	2	2" i.d. PVC slip elbow
J	1	1/2" x 2" dia. plywood disc
K	1	1 1/2" i.d. metal-to-plastic adapter with male iron-pipe thread
L	1	1 1/2" dia. x 13' or more wirebound rubber hose; for a source, refer to the classified pages, "rubber products"
M	2	1 1/2" hose clamps
N	1	adapter for hose nozzle
O	1	1 1/2" plastic fire-hose nozzle tapering to 1/2" outlet; available at rubber-hose suppliers; see L, above

Misc.: Epoxy adhesive

Blown-in insulation—you can do it yourself

During the past five years, the electric rates to cool and heat my frame house have doubled. To lower my electrical bills, I decided to insulate the walls.

I investigated the types of insulation on the market and found one that I could easily blow into the walls, W.R. Grace Zonolite Masonry Insulation. Although the vermiculite insulation is primarily used in new cement-block construction, it is suitable for wooden-wall cavities. It's water repellent and won't support combustion. To inject it, I built a blowing machine for \$50.

You can purchase a used 55-gal. drum (A) with a removable lid to make the blower. Be sure the lid has a clamping ring and rubber gasket (B). Cut two holes exactly to size in the lid (see drawing). First, bore an entry hole; then use a sabre saw with a metal blade. Over one hole, mount a used

1 1/4-hp shop vacuum-cleaner motor (C) with dust cover (D). Fasten the motor on the outside of the lid with a gasket (E) so it blows into the drum.

In the other hole, use epoxy adhesive to attach pipe (H) and install slip elbow (I). Cap the elbow by cementing in plywood disc (J). To fill the drum with insulation, remove the elbow and use a funnel.

Cut holes in the drum to suit the electrical cord (G) and the metal-to-plastic hose adapter (K). Cement the adapter to the drum with epoxy adhesive (or bolt on flange and screw on adapter). Attach 13 ft. of wire-bound rubber hose (L) to adapter (K) with hose clamp (M). Use another adapter (N) and hose clamp (M) to attach a 1 1/2-in. plastic fire-hose nozzle (O).

Fill the barrel with the contents of one bag (20 lbs., 4 cu. ft., about \$5) of insulation at a time. I cut a 2 3/8-in.-dia. hole in a

paper paint bucket and used it as a funnel, centered over the PVC fitting (H). When blowing insulation, cap fitting with elbow (I) and disc (J).

Bore 5/8-in.-dia. holes in house exterior centered between studs, 2 in. below ceilings and windows. Drop a plumb bob into holes to check for fire stops. Bore a second hole below each stop; check for other obstructions until plumb hits bottom.

Before blowing insulation into the walls, seal cracks around electric-outlet boxes. Blow insulation into each hole for 15 seconds. Look for leaks at the house sill. Fill with insulation cut from batts. Then completely fill all wall cavities. Plug each hole with a 5/8-in.-dia. wood dowel cut as needed. Putty, sand and paint each area.—*Montgomery L. Young*

(Editor's note: As with any job of this type, you should wear a respirator. The insulation can contain trace amounts of asbestos, though tests have shown it meets federal safety guidelines.)

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to bag clippings
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The RMX through-the-deck
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But the owner of a Jacobsen
RMX also knows that once people
see his Jake, they want to borrow it.
So to *keep* his best friend he has to
be more than smart.

HE HAS TO BE VERY CLEVER.

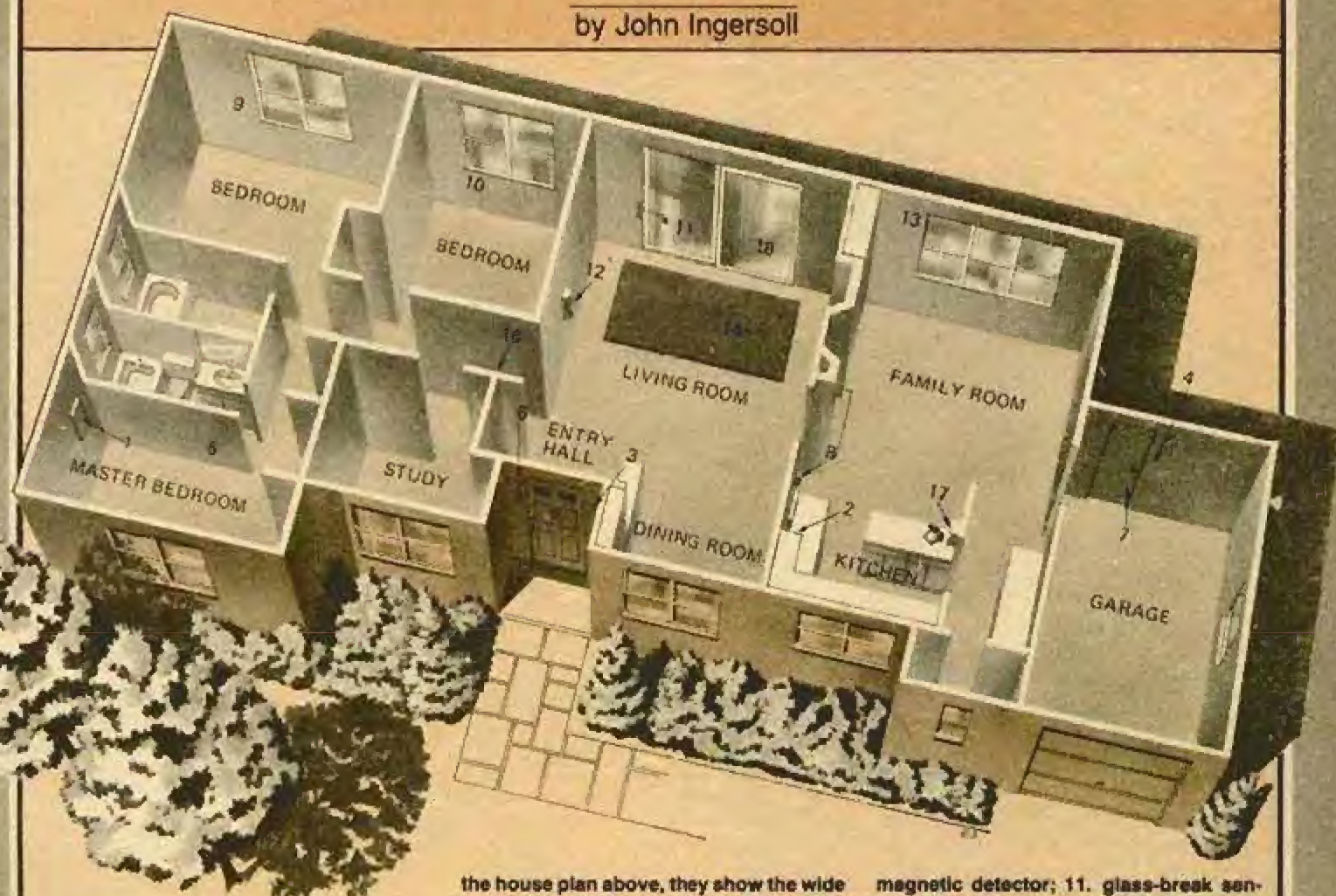


GET THE BEST. FOR YOURSELF.

NEW WAYS TO KEEP THIEVES OUT OF YOUR HOME

The burglary rate is rising all across the country. Here's how a central alarm system can save your valuables—and peace of mind.

by John Ingersoll



How to put an electronic "fence" around your home: Studies show that alarms triggered by a network of detectors throughout a house will scare away 98 percent of all burglars. While most homes will not have all the security devices indicated on

the house plan above, they show the wide variety of aids available. They are: 1. master control; 2. remote master; 3. indoor remote switch; 4. outdoor remote switch; 5. manual emergency (panic) button; 6. reset button; 7. shunt switch; 8. light-flasher relay; 9. surface-mount magnetic detector; 10. recessed

magnetic detector; 11. glass-break sensor; 12. ultrasonic detector; 13. alarm-wired screen; 14. pressure-sensitive floor mat; 15. outdoor alarm horn; 16. indoor horn; 17. automatic telephone dialer; 18. photocell detector. System parts by NuTone Div., Scovill, Madison and Red Bank Rds., Cincinnati, Ohio 45227.

"We don't need a burglar alarm when we're home," said a Philadelphia contractor. Not true. While he and his family were eating dinner last summer, a "cat burglar" hoisted himself up to a small second-story balcony outside the master bedroom, entered quietly through French doors, swept valuable jewelry into a pillowcase and left as he came.

"The house is completely locked. We aren't worried about thefts," said a Minneapolis couple. Wrong again. Return-

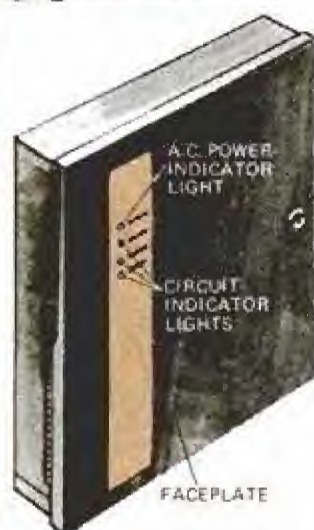
ing from a two-week vacation, they found their house stripped. The thief had broken a window, reached in to release the sash lock and entered easily.

"I always leave the door unlocked. Nothing ever happens here," said a bachelor in Laramie, Wyo. Back from an evening movie, he found his house ransacked.

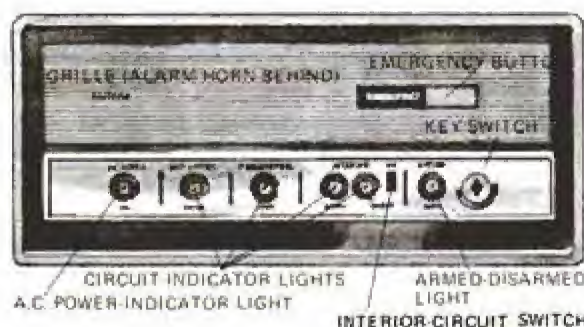
In all three cases, the owners slammed the barn door after the horse was stolen. They now have burglar-alarm systems.

More and more families are now turning to some form of alarm system as word-of-mouth brings grim tales of theft in the homes of relatives, neighbors or acquaintances. FBI figures back up fears. Residential burglaries in New York State rose 13 percent from 1978 to 1979 (the most recent period for which statistics are available). This startling increase reflects similar jumps in thefts throughout the nation, and the agency expects a gloomier report for 1980.

Alarm systems—all of which consist



Master control panel (left) connects all components in system. LEDs indicate if system is operating properly and, if not, where trouble lies. It has standby battery and connections for extra circuits. Remote master (below) is similar, but styled for use in bedroom, kitchen or other living areas. It has its own alarm horn behind decorative grille, panic button, indicator lights.



It can also house an alarm of its own, usually behind a decorative grille. What the panel gives you is a second opportunity to oversee the system.

There are also more simplified remote controls that fit into standard electrical outlet boxes. These lack the features of a master control, but are less expensive and can be installed anywhere, even in weatherproof fixtures outdoors. Consisting of key-operated switches, they let you arm or disarm the system at points distant from the central control.

Exit/entry devices

Obviously, you and the members of your family must have a way to enter and leave the house without triggering the alarm yourselves. Several options are open to you: digital signals code-set to allow you time to enter or leave, key locks that let you disarm the system momentarily, or a simple button switch to deactivate the system for a preset interval, usually just long enough to let you get in or out the door.

Whatever its form, the exit/entry device is both a necessity—and a nuisance. It's been labeled by many alarm-system owners as the "false-alarm trigger." The device—or actually the failure to use it properly—seems to set off more "cry wolf" calls than any other single component. You go to let the dog out, forget to disarm the system and suddenly—wham!—off goes the alarm with a deafening blast, disturbing neighbors and sometimes bringing the police on the run.

A shunt switch allows you to open a

of a network of detectors connected to a central control—range in price from \$120, uninstalled, to \$5,000, installed and monitored by a private security agency for a monthly fee of \$15 to \$25.

There are similarities among the components in every system. Choosing the right combination for your home is much easier if you know how the parts perform and what, if any, their respective drawbacks are.

A full alarm system runs one or more perimeter circuits from a central control, arming all windows and outside doors. It may also include one or more interior circuits, laying traps for an intruder who manages to elude the perimeter loops. A full system generally ties in fire protection as well, a subject we'll explore in a future issue.

A number of systems are sold in kit form, with instructions for do-it-yourself installation. Inexpensive systems are the easiest to install, mainly because they consist of fewer and simpler parts.

As the price goes up, so does the sophistication and the time it will take to hook everything up. The actual wiring, however, is fairly simple, since alarm systems almost universally operate on 12 volts, permitting the use of easy-to-run, low-voltage cable. A transformer is connected between house current and the central control, and there's usually a standby battery to provide backup power in a blackout.

Here are the parts common to most systems:

Central control panel

The central control panel is the heart of any full alarm system. It contains a relay that transmits signals from the detectors to an audible alarm in the house or to the security station monitoring your system. Most controls also dis-

play signal lights, indicating power on/off and whether or not the circuits are armed.

Control panels are used for both wired and radio-transmitted alarms. Choose a wireless network if it's too much of a hassle to conceal the wires and surface wiring will appear too unsightly.

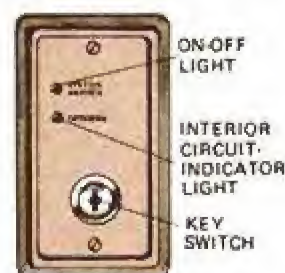
In a radio system, the central control plugs into a 115-volt outlet and has a 12-volt backup battery. Battery-operated radio transmitters, wired to perimeter detectors, send a signal to the control panel when a break-in occurs, and the panel sounds the alarm. This system goes in more easily than the wired type, but does have a drawback: Not everyone remembers to replace batteries regularly, and a dead one could knock out your protection.

In a wired system, the central control panel is connected through a transformer to your house wiring and contains a rechargeable battery for emergency backup power. Wires connect it to your door and window detectors, forming a continuous loop of protection. A break in the circuit at any point in the loop causes the alarm to sound.

The control panel is usually installed in an out-of-the-way place, such as behind a door in a bedroom or den. Some people prefer to conceal it in a closet, where it's out of sight, although not as convenient to monitor if you want to be able to see its indicator lights.

Remote controls

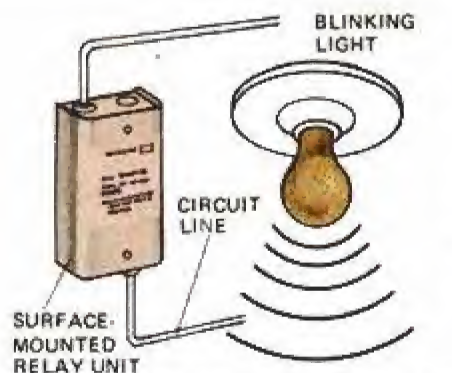
A master remote panel is similar to the central control panel, but can be installed in any remote location where you want to keep tabs on the system. Often it's attractively styled so it can be openly displayed in living areas, such as the kitchen or master bedroom. Its signals tell you the same information as the main control panel—sometimes more.



Remote key switch fits standard electrical wall box, allows you to arm or disarm system at points distant from master control. Similar switch is made in weatherproof style for outdoor use so you can control system from porch deck or patio.

Panic button lets you sound alarm manually if you suspect intruder is trying to break in. You can have one by your bed, others elsewhere. Similar control boxes house reset buttons for rearming system after it's been triggered and shunt switches to temporarily disarm door or window.





Light-flasher relay turns on house lights (up to 1,000 watts) if a detector is tripped. It can also blink lights on and off in rapid succession to scare away a thief.

door briefly without tripping the alarm. This is a form of disarming control, but it deactivates only one detector, not the whole system. The switch releases the door detector from the perimeter circuit loop until the switch is flipped on again. The same switch lets you open a bedroom window at night for fresh air without setting off the alarm or having to deactivate the entire system. You must remember to reset a shunt switch, however. Unlike a timed exit/entry control, it will not reset itself automatically.

Emergency switches

Emergency switches—more familiarly known as panic buttons—do just what their name implies. They allow you to trigger the alarm manually any time you think an intruder is attempting to break in or in other emergencies where a loud alarm might be useful in calling for help. Install the buttons at key locations, such as next to your bed and in an upstairs hallway.

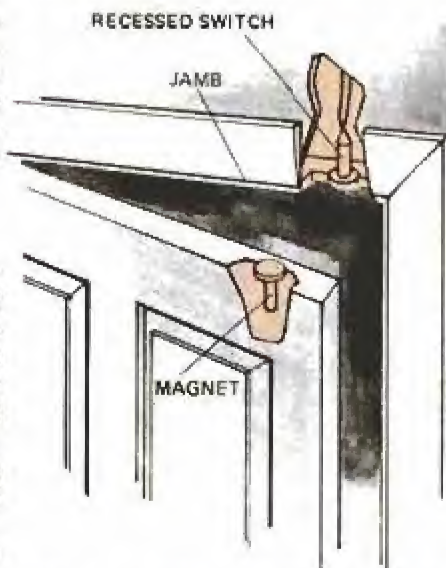
There's even a pocket version of the

panic button. It's a radio transmitter that can signal a central wireless panel. You can carry it with you and press it if you think the delivery boy is a mugger in disguise.

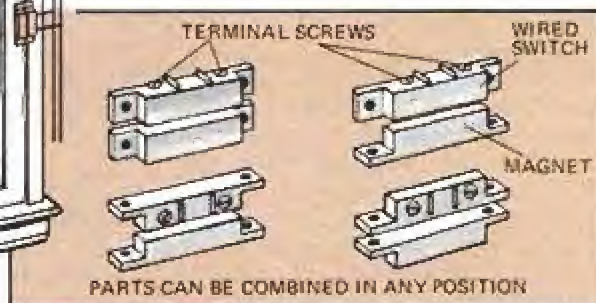
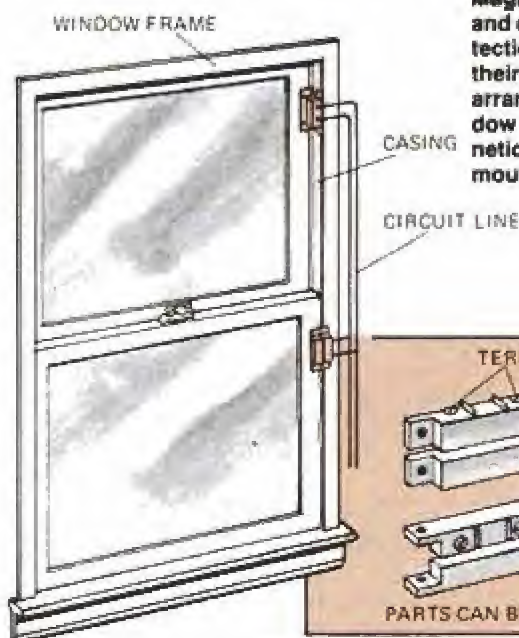
Another type of remote control is a reset button that puts the system back into operation after the alarm has been set off by an intruder—or a forgetful child. In some systems, this is a key-operated switch instead of a button, but it does the same thing. Install a reset next to the central control panel if it doesn't contain its own reset (some do). Another possibility: alongside entry doors, where many false alarms are triggered.

Magnetic detectors

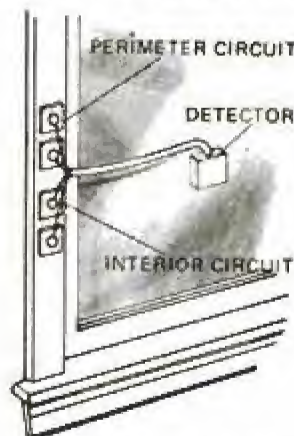
Magnetic detectors are used to protect entry doors, sliding glass doors, garage doors and any form of window that opens. These consist of two parts: an unwired magnet and a wired switch



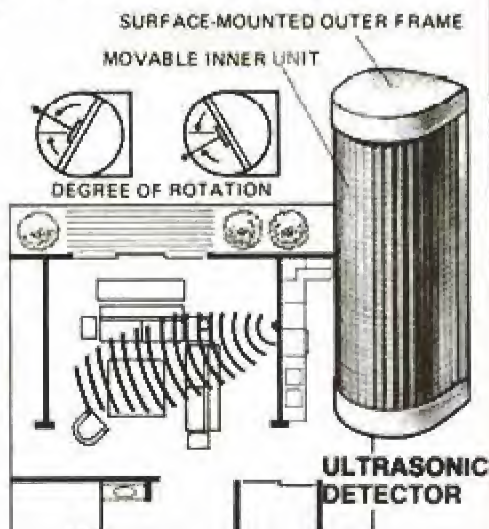
Magnetic detectors install on windows and doors to form continuous loop of protection to encircle house. Magnets and their magnetically controlled switches are arranged in closely spaced pairs. If a window or door is opened, it breaks the magnetic field, triggering alarm. Surface-mount type (left and below) is easiest to install, but recessed type (above) looks neater, is harder for a burglar to spot.



GLASS-BREAK DETECTOR



Glass-break detector is tiny device that sticks to large picture window or sliding glass door. Sensitive to vibration, it sounds alarm if glass is broken, but won't trip if jarred only by wind gusts.

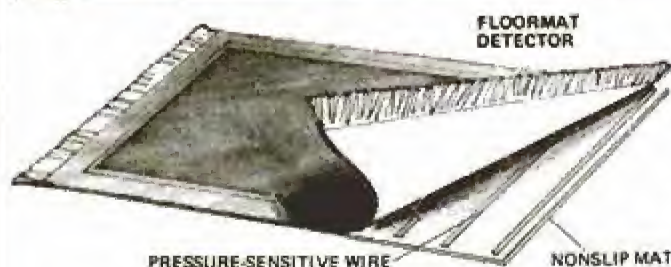


Ultrasonic detector protects broad interior spaces. It sends inaudible sound waves through a room. If waves are disturbed by someone crossing their path, it sounds alarm. Transmitter swivels to aim it for desired area of coverage. Other area-type detectors use either microwaves or heat-sensing infrared (see text).

that is controlled by the magnet. The two are arranged with a slight gap between them so as to maintain a constant magnetic field.

In the surface-mount type, the magnet is screwed to the part of the structure that moves—the edge of a door or the sash in a window. The wired switch is attached opposite it in a fixed position on the door or window frame. When the door or window is opened, it breaks the magnetic field, and the switch signals the master control, which then sounds the alarm.

The clever part about this system is that it's constantly energized so that a break anywhere in the circuit—not just at a detector—will automatically trigger



A pressure-sensitive floormat hidden under rug or stair runner flashes the alarm if stepped on. They're good for doorways, halls and areas difficult to protect otherwise. Disadvantage: Pets trip them.

the alarm. Thus, if a thief attempts to deactivate the alarm by cutting the wires, he instantly sets it off.

Hidden detectors

If you prefer a concealed system, recessed types of magnetic detectors are also available. These fit flush into the edges of doors and windows and are almost invisible. They take a lot more work to install, but they improve the looks and, more importantly, disguise your protection from an intruder peering inside. If a thief can see the magnets, he might attempt to defeat the system. (Some alarm systems can be fooled, but we think it best not to discuss the methods here.)

Another type of door and window detector is mechanical and less reliable. Called a plunger detector, it signals for an alarm when its plunger is depressed as little as $\frac{1}{4}$ inch. Its problem is that moisture in the air can corrode the plunger, eventually jamming it.

There's more. You've seen how commercial establishments are protected with strips of metallic foil around the edges of windows. This system is also available for home installation and is not a bad idea for a large expanse of fixed glass. Smashing the glass breaks the foil tape, instantly sounding the alarm. The tape can be wired into the same system as magnetic detectors so you can have magnets on windows that move and the foil on those that don't.

If foil tape seems too unattractive, you can select a glass-break detector. This is a tiny device that's handy for sliding glass doors and big picture windows. About the size of a 50-cent coin, one detector fastened to the glass is sensitive to breakage anywhere on the sheet, but isn't affected by vibrations caused only by wind. If the glass shatters, the alarm sounds.

Sophisticated sensors

Area protection inside the house is provided by some of the more dramatic devices. Newest among these is the infrared heat sensor. It sends out finger-slim beams of invisible infrared light, ready in an instant to detect any change in temperature. It won't trip when morning sun streams in a window, but will sound the minute a human body at 98° F. passes through the beams.

Another type, the ultrasonic detector, sends out sound waves inaudible to human ears. The device is both a transmitter and receiver. When the pattern of sound waves received is different from that of the waves sent out, it indicates that the waves have been disturbed by someone crossing their path, and the alarm sounds.

A third device, the microwave detector, is also a transceiver. It floods the area with high-frequency radio waves (not injurious to health). The detector, monitoring the reflected energy, notes when the waves have been distorted by someone moving through them and sounds the alarm. A problem: Pets or small children can trigger the alarm.

Sliding glass doors and other doorways can also be protected by photoelectric cells using beams of invisible infrared light. A transmitter and reflector are installed on opposite sides of the door. If someone breaks the reflected beam, the alarm sounds.

Pressure-sensitive mats

Pressure-sensitive floormats, laid under rugs or stair carpet, will signal the central control when a person (even a dog) walks on them. These are good for doorways, halls and sliding glass doors, but can be a problem when someone sleepily goes downstairs for a late-night snack and forgets to disarm them.

An audio detector should be mentioned, too. Stationed centrally in the house, it detects the sound frequency made by breaking glass. It's a good idea if your house has a lot of vulnerable glass area, but shouldn't be needed if the perimeter is well protected by other devices.

Alarm-wired door and window screens offer added protection. You might want to consider them if your house is hidden from street view or in a remote location where a burglar would have more time to work unnoticed. An alarm sounds if the screen is cut or removed.

Indoor and outdoor alarms

The alarm itself is either a loud bell or blaring horn. You can choose an indoor type, an outdoor type—or both. An indoor alarm is loud enough to wake you when you're home and is usually frightening enough to scare off an intruder

even when you're away. However, it probably won't be heard by neighbors.

An outdoor alarm will rouse the entire neighborhood and perhaps even get the attention of a nearby patrol car. On the other hand, you can't always count on neighbors to call the police for you—they may not be home or, more likely, may tire of the game after about the third false alarm. For this reason, most installations include both an inside and outside alarm. An added bonus: If a thief cuts the wires to an outside alarm, the inside one will still sound.

What happens if a thief cuts your 115-volt house wiring? Will the alarm be deactivated? No. It will immediately switch over to power from the 12-volt backup battery and remain armed. If the intruder then interrupts the perimeter wiring at any point, the alarm will go off. This gives you protection if the power goes out for any reason, but at the same time, prevents the alarm from sounding during a storm-related blackout.

Telephone alerts

Three less noisy options are also open to you. One is a simple light-circuit relay. When signaled, it switches on all house lights connected to its circuit. It can also be set to flash the lights on and off. Often, this is enough to frighten off an intruder.

The second is an automatic tele-



OUTDOOR ALARM

Outdoor alarm horn sounds electronic wail at 102 decibels, loud enough to rouse entire neighborhood. Indoor horn at 85 db. wakes sleepers. Most installations include both. Advantage: If outdoor horn is cut, indoor one will still sound alarm.

phone dialer combined with a tape recorder. You prerecord a message on tape, saying your house is being burglarized. When an actual break-in occurs, the dialer silently rings a preselected number—a friend, neighbor or the police. Unfortunately, the police in some areas may not permit automatic dialers to be set to their number (because of the nuisance of false alarms).

Better is a silent, digital telephone dialer that sends a coded signal to a central security station. This is the most expensive route to take, but also the closest to being foolproof. False alarms are intercepted before neighbors or the police are unnecessarily alerted. **FME**

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These twin beds stack up as a dandy couch

by Rosario Capotosto





Practical and easy-to-set-up beds turn bedroom or family room into guest room in one easy step. Stacked as couch (right), the top unit completely conceals mattress of lower bed. A quality $\frac{3}{4}$ -in. plywood is used throughout.



This attractive furniture is perfect for a teen-ager's room. By day, it can be used for extra seating when the gang is over to listen to records or do homework; at night it becomes the teen-ager's bed. Best of all, it quickly transforms to sleeping for two, should your youngster want to ask a friend over for the night.

This project was developed in conjunction with Georgia-Pacific, the plywood company. The beds were built in the Popular Mechanics' workshop based upon a design idea in a booklet published by that firm. We did vary certain dimensions so that the beds would stand exactly the same height when in the twin-bed attitude. But, the looks remain the same.

The beds are easier to build than you might think. Simple notch and tenon joints are used at the corners, and we include a design for a cutting jig in our plans. You can build the set using basic workshop tools.

A critical point in the construction is the position of the ledger cleats in both of the units. *They are not alike.* The cleats are placed so the beds will fit together properly at a height that is comfortable for sofa-seating, yet stand the same height when they are parked side-by-side. They are built of cabinet-grade birch plywood (lumber-core.)

Both beds are made to suit a 6 x 39 x 75-in. mattress. For a different size, change the dimensions on our plans to suit.

If the beds are to be painted, you can

[\(Please turn to page 157\)](#)

PM photos: Harry Hartman

Styling: Gabe Herrick

Construction by the author

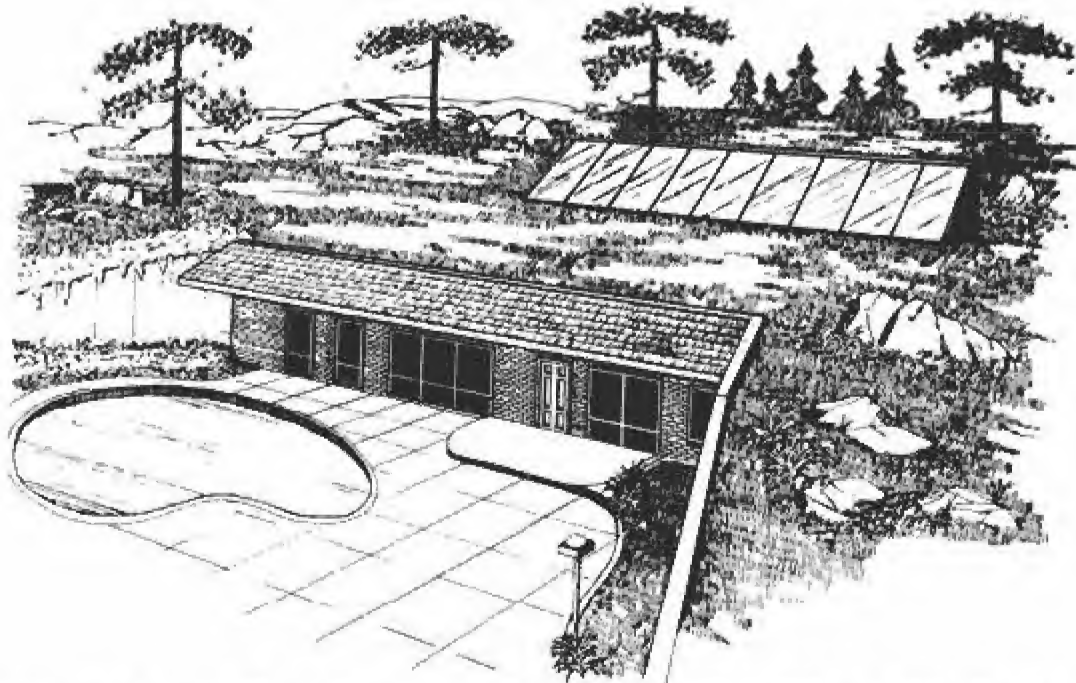
Wallpaper: Fabulous wallcoverings of N.Y. and N.J. 43A Nyack Knolls, Route 59 Nyack, N.Y. 10960

Desk, chair, lamps: Conrads 145 Huguenot St. New Rochelle, N.Y. 10801

Chest of drawers: Gothic Cabinet Craft, 104 Third Ave., New York, N.Y. 10003

Mattress: No. 114-70142N from Sears Roebuck and Co.

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Lay out parts for notching with combination square and pencil. To avoid errors, indicate the waste areas with an X.



Two cleats nailed to scrap board clamped to the drill-press table serve as stops to assure accuracy for blade-entry holes.



A pair of cleats nailed to jig also act as stops; these assure accurate lineup of each piece. Work can be cut face up if a very smooth cutting blade is used.



Rotate the jig 90° when making the next two cuts to drop out waste. Crosspiece on the jig is square and supports saw base.



Start tenons by making the two cuts from the end on the table saw. Use a high blade to achieve the minimum undercut.



Make shoulder cuts with a guided sabre saw. Square guide cleat with workpiece and attach it with clamps as shown.

STACKING TWIN BEDS

(Continued from page 155)

use fir or MDO plywood. If you want a clear finish, use lumber-core plywood with veneer of your choice. Lumber core gives attractive wood edges instead of plies. Buy domestic plywood to avoid mismatched colors, which are common in imported core materials. You may also avoid interior voids, and knots generally present in the imports.

Use a portable circular saw with a hollow-ground blade to rip the plywood panel into 7½-in. widths. The saw shoe should ride against a clamped straightedge guide to ensure straight cuts.

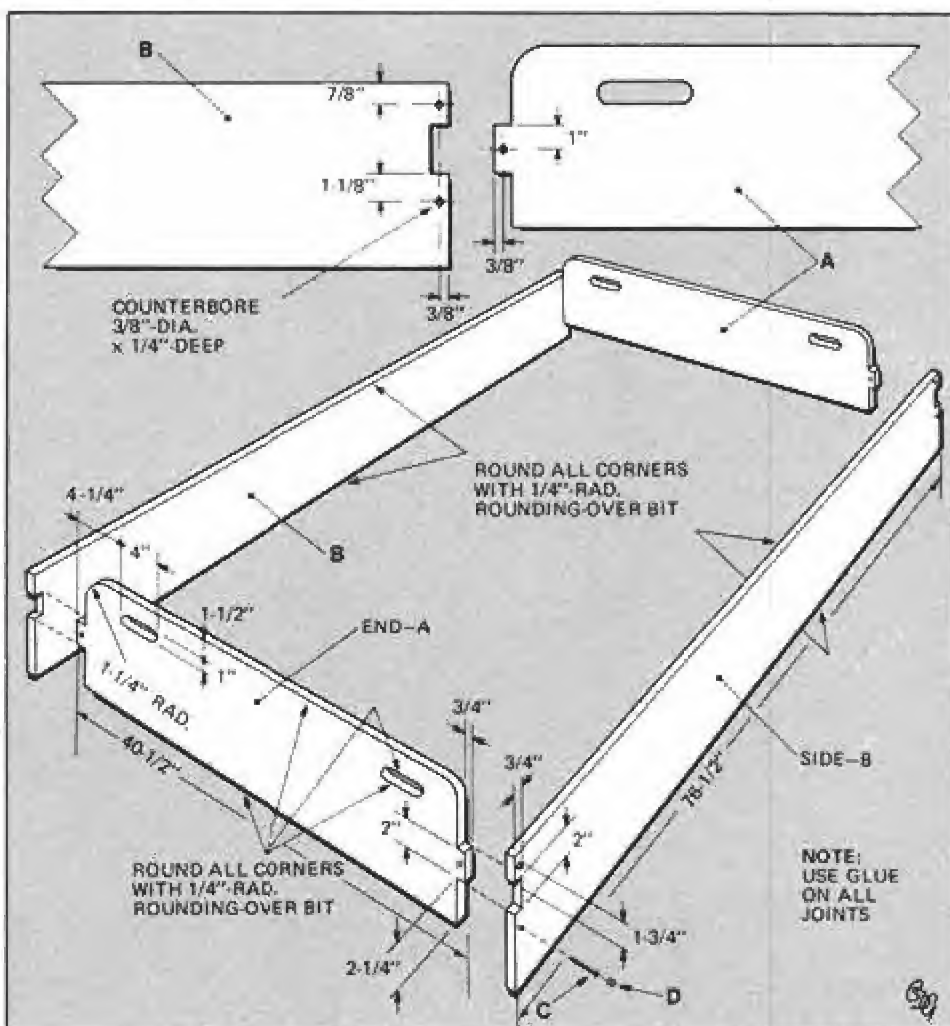
Mark the ends of the boards for notching and indicate the waste area to be cut out to avoid an expensive error.

For accuracy, use the jig shown in the plan to cut notches and tenons on the bed frame. If you have a table saw, set its blade high to make the short end cuts (a high blade minimizes the length of kerf on the underside of the work). Or, you can do all of the cutting with the sabre saw and jig.

Bore a blade-entry hole tangent to the cutting lines to make inside cuts for the notches on the side members. Since it is best to work with the face-side up, use a fine-tooth sabre-saw blade with a slow feed, to avoid splintering the edges.

Bore two 1-in.-diameter holes and

(Please turn to page 159)



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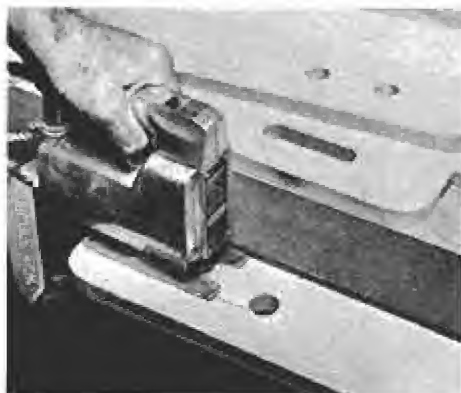
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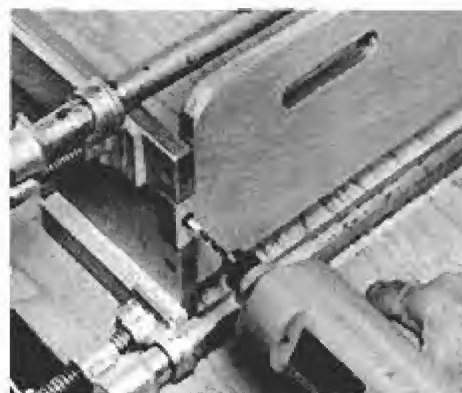
State _____ Zip _____



Bore two holes for the handles. Then position saw guide so that saw blade is on the line. Use fine-tooth blade for this setup.



Round corners of all exposed edges with a router and a rounding-over bit. Do not round the edges in the area of the joints.



Lastly, hold the bed together with bar clamps to bore pilot holes for screws. Counterbore holes first for wood plugs.

STACKING TWIN BEDS

(Continued from page 157)

make two guided sabre-saw cuts to create the handle holes. Round all exposed corners with a $\frac{1}{4}$ -in.-radius, rounding-over router bit. Be careful when routing top and bottom edges of the sides and ends not to round over edges in the joint areas.

Assemble the bed components with bar clamps so you can bore pilot holes for the screws accurately. Use a $\frac{1}{16}$ -in. bit first; then counterbore $\frac{1}{4}$ -in. deep by $\frac{3}{8}$ -in. diameter. After you bore the largest hole, drill the shank and body holes.

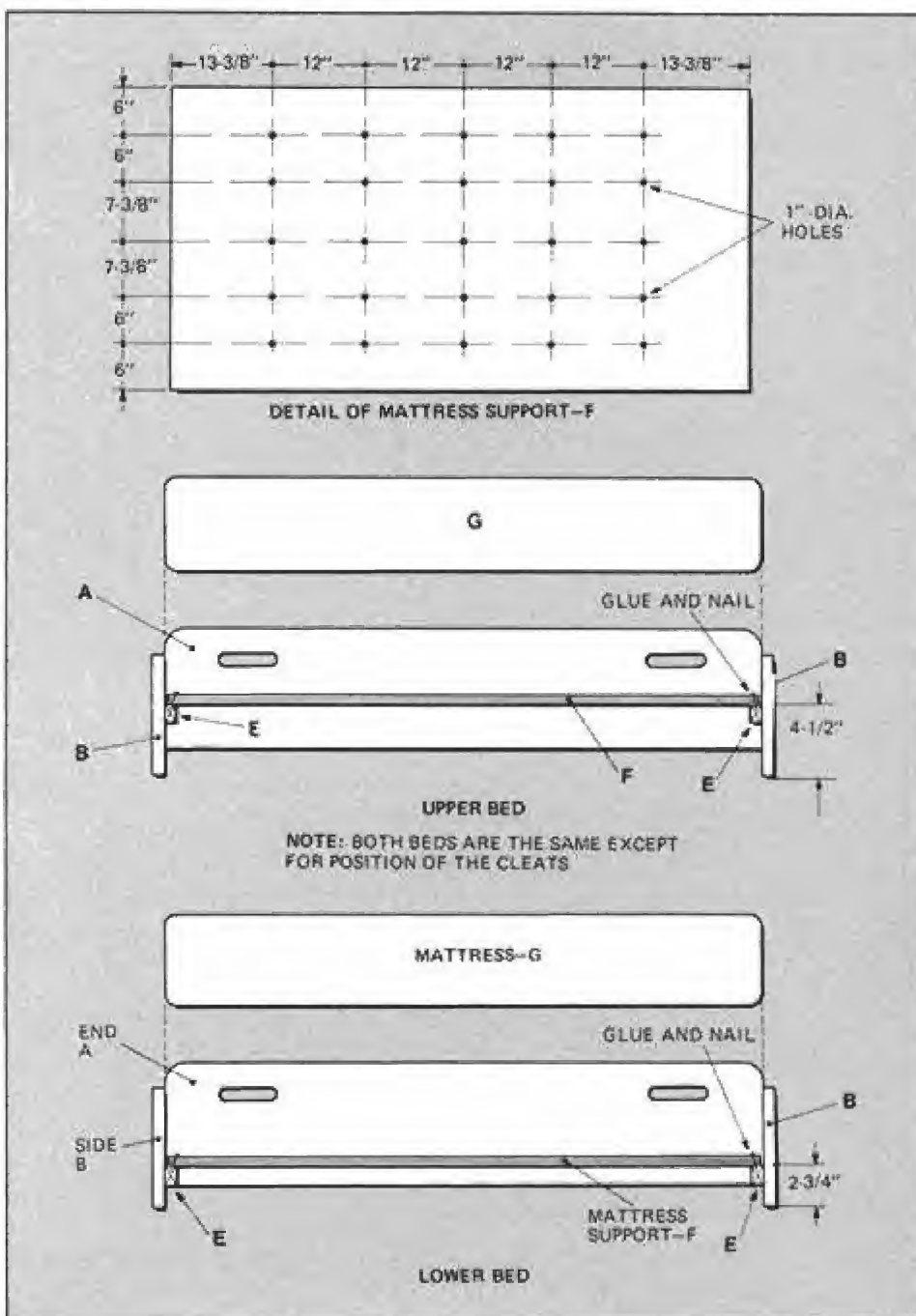
Use carpenter's glue and $\frac{1}{4}$ -in. common nails to attach the ledger cleats. This is best done before the sides are assembled. Use glue and No. 10 \times 2-in. flathead screws to join the sides and ends. Cut dowel plugs from solid stock to conceal the recessed screws.

Make certain you bore ventilation holes in the $\frac{1}{2}$ -in. plywood mattress supports;

then glue and nail them into place. Apply stain or finish as desired.

The booklet featuring this bed design is no longer available. Georgia-Pacific, however, offers a booklet titled, "Redi-

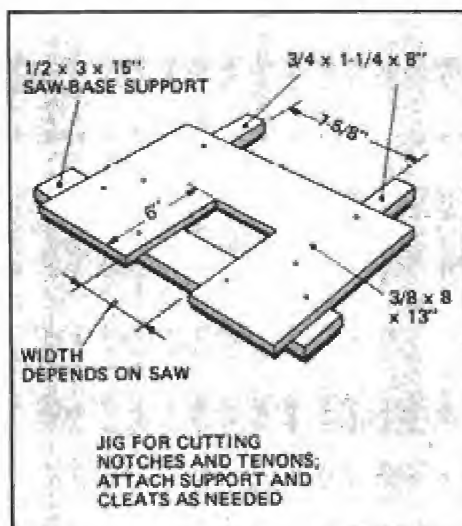
Cuts," which features other good project ideas. You can get it free at lumberyards and home centers, or write to Georgia-Pacific, Dept. PM 481, 900 Southwest Fifth Ave., Portland, Ore. 97204. **PM**



MATERIALS LIST—STACKABLE BEDS

Key	No.	Size and Description
A	4	$\frac{3}{4} \times 7\frac{1}{8} \times 40\frac{1}{2}$ plywood
B	4	$\frac{3}{4} \times 7\frac{1}{8} \times 76\frac{1}{2}$ plywood
C	24	2" fh wood screws
D	24	$\frac{1}{4}$ " \times $\frac{3}{8}$ "-dia. dowel plugs
E	4	$\frac{3}{4} \times 1\frac{1}{8} \times 75$ ledger-cleat
F	2	$\frac{1}{2} \times 38\frac{3}{4} \times 74\frac{3}{4}$ plywood
G	2	6 \times 39 \times 75" foam mattress

Misc: carpenter's glue, nails, sandpaper, finishing materials.



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We're looking for work.



Build this outdoor harvest table with your chain saw

PM color photo: George Ancona; how-to photos: Rosario Capotosto

Although the rough-hewn features of this handsome table and bench set give an impression of stability and agelessness, you can actually build it in a weekend work session, if you organize your work schedule. The sturdy furniture will withstand years of use and weather in your backyard and retain the same timeless appeal that it has today.

This rustic furniture is a joint project developed by Homelite and *Popular Mechanics*. Cutting the large wood members that

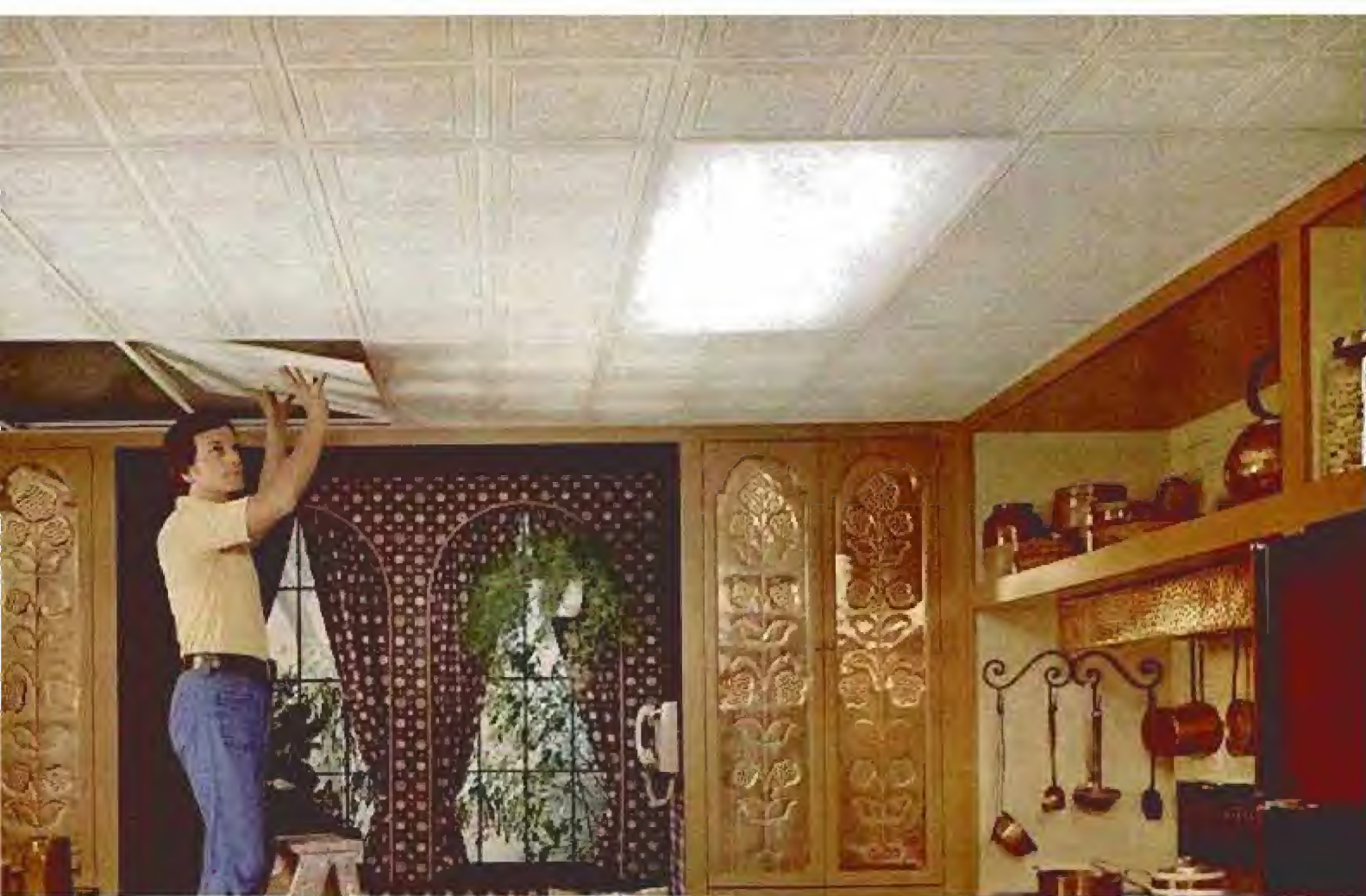
One weekend work session is all it takes to build this handsome yard set.

give the furniture its rugged look is made easier with a heavy-duty saw such as a Homelite or other chain saw. The construction design is by Rosario Capotosto based on a drawing by David Stiles.

Legs on the benches and table are of 6×6 Wolmanized lumber notched at the top to receive doubled 2×6 supports for the top and seats. Both the table and benchtops are 2×4s laid on edge and bolted together with a threaded rod.

Begin work by cutting the posts (E and F, see drawing and

[\(Please turn to page 164\)](#)



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When crosscutting a heavy overhang section, make two cuts from opposite sides. This will prevent the wood from splitting.



Make four or five kerf cuts to notch out the post top. A length of wood across the back is the depth guide for each cut.



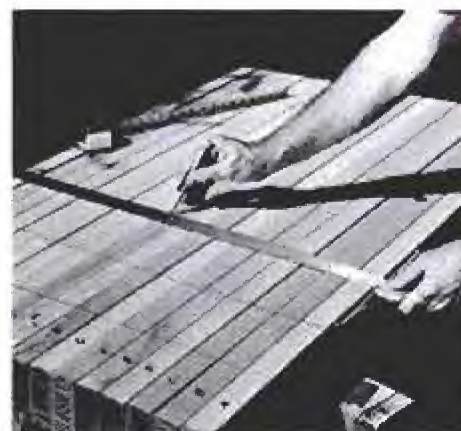
You can break out the waste slices by hand. If some pieces are stubborn, clean them out with a chisel or a pinch bar.



In order to level the bottom safely, you can easily make use of the chain saw itself.



Make a short crosscut at the end; then make an angle cut to avoid splitting. Saw's anti-kickback tip and hand guard add to your safety while working with the tool.



Line up the 2x4s with their best surfaces on top. Identify each piece in the order of assembly. Mark them for the bolt holes.



If you must bore the holes with a portable drill, a drill guide is invaluable. Bore the larger holes on outside members first.



Hold the saw at a 45° angle to trim off the excess. Be sure to keep your body entirely to the left of the chain line.



Use a belt sander on the edges. Assemble the top carefully so it won't need sanding.

materials list at the end of the story). Post stock is usually available in 6-, 8- and 12-ft. lengths. *Be sure to wear safety goggles at all times while you're working with the chain saw.*

To avoid tearing the ends of the wood when crosscutting, first make a partial cut from one edge of the wood. Then turn the

stock over and complete the cut by sawing through from the opposite side.

The tops of the posts are notched to accommodate the supports for the furniture tops. Before you make the notches, set the posts in the ground. However, the posts must be placed accurately or you will have alignment problems later. You

may find it easier to construct and assemble the units out of the ground, and then plant them.

Begin work on the notches by cutting a series of saw kerfs. To make these cuts the post must be rigid. So, if it is not in the ground, first clamp the post to a sturdy

(Please turn to page 166)

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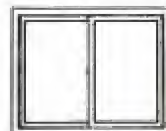
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026-0481

support such as a sawbuck. Mark the outline for the notch and tack-nail a strip of wood across the post to serve as a visual guide for the depth of the cut. Start the cut with the chain bar pointing slightly upward. Level the bar off as the cut progresses; continue until you reach the guide stick.

After you've made several side-by-side kerf cuts, you may be tempted to tilt the saw sideways to nibble away at the bottoms of the waste slices. *Don't do it*—you could easily lose control of the saw and experience a kickback, as the teeth at the top of the bar strike wood and cut in the opposite direction. It's much safer to

break away the waste slices by hand or with a chisel. Then you can use the saw to level off the remaining stubs at the notch bottom.

Cutting the top supports

Next, cut the angled supports (C) for the tabletop, and the supports (D) for the benchtops. Clamp a 2×6 support board to a pair of sawhorses and make a partial crosscut to establish the end. Then make the angled cut to meet it. In this way, the piece will make a clean break from the waste without splitting. Nail two supports together and smooth the edges with a belt sander. As an alternative, you can join the

two pieces of 2×6 together first, and then make the cuts in one pass.

Insert the supports into the posts, clamp them if necessary, and bore the holes for the lag bolts. Put these aside.

Making the furniture tops

Align the 2×4s (A and B) for the table and benchtops on their edges. Select the best surfaces for the face sides. Arrange the 2×4s so that any slightly warped ones are positioned in alternate directions to counteract each other. Severely warped or twisted stock should not be used.

Mark the pieces so the tops can be reassembled later, in the same order. Use a T-square to mark the locations for the threaded rod holes.

If you have a drill press, clamp a stop to the table to simplify centering across the width. Otherwise, use a drill guide such as the Portalign to bore all holes perpendicular. First, counterbore the holes on the two outside members to recess the nuts and washers. Bore the larger hole first, otherwise, the drill center will be lost.

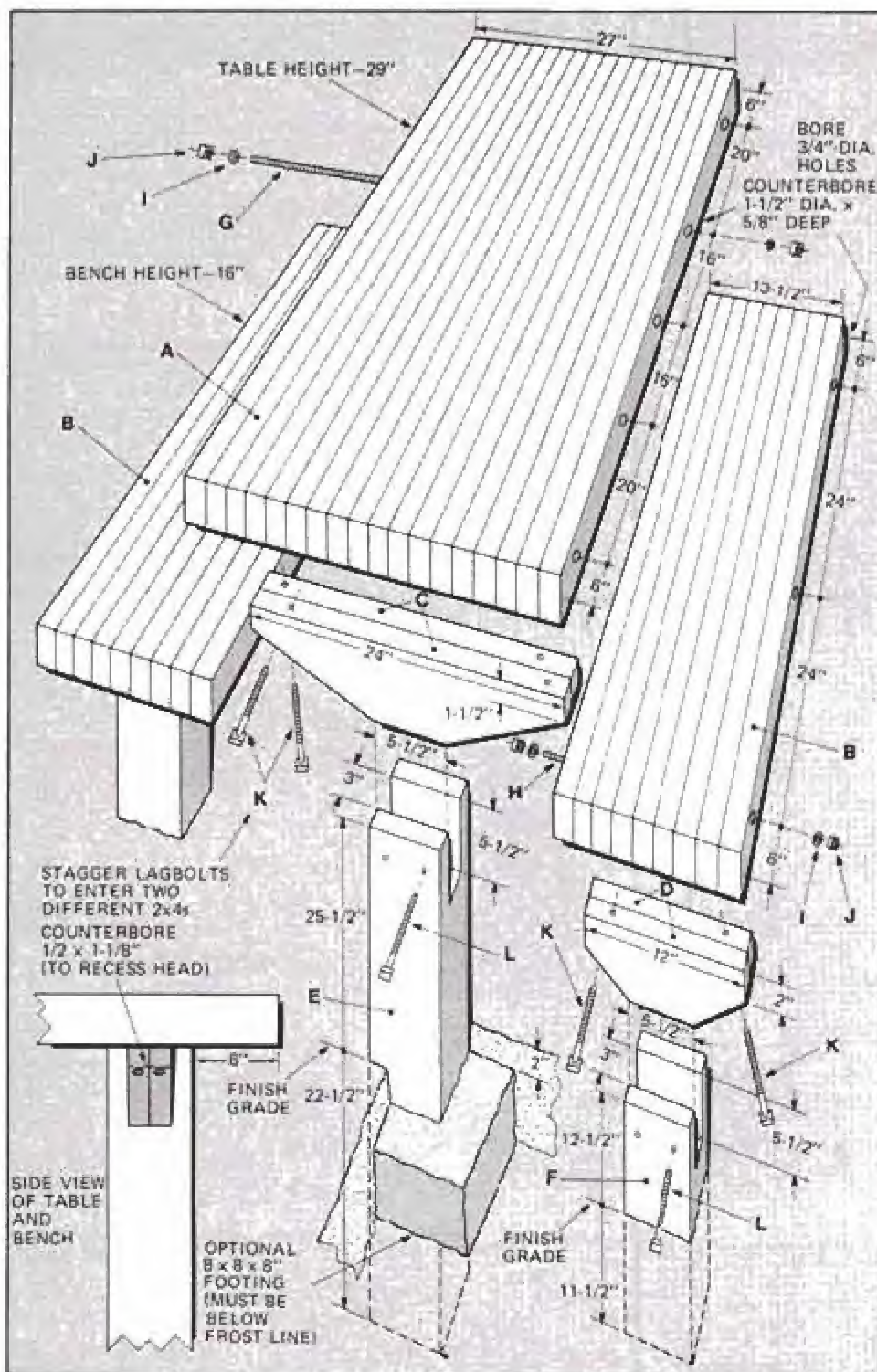
Cut the 1/2-in.-dia. threaded rod to length and grind off the burrs. Assemble the pieces and clamp strips of wood across the top and bottom at both ends and in the center to obtain a good surface alignment. Insert the threaded rods and washers. Then secure the nuts at both ends, using a pair of socket wrenches.

If you use stock size 2×4 lumber, you'll have to trim off the waste at one end. You can easily do this with the chain saw. However, the resulting edge will be rough and will need smoothing with a belt sander and 80-grit paper.

Assembling the pieces

You can use the same procedure to assemble both the table and the benches. Begin by turning one of the tops face down on the ground. Bore holes for the lag screws through the supports and into the top. Assemble and place the unit into the holes that have been dug for it. Repeat for the other furniture pieces.

Back-fill and tamp the earth firmly. You can top off the holes with 6 or 8 in. of cement for extra stability if you wish. For added permanency, consider pouring concrete collars around the posts. **FM**



MATERIALS LIST—TABLE, BENCHES

Key	No.	Size and description (use)
A	18	2×4' = 7' Wormanized lumber (tabletop pieces)
B	18	2×4' = 5' Wormanized lumber (benchtop pieces)
C	4	2×6×24' Wormanized lumber (tabletop supports)
D	8	2×6×12' Wormanized lumber (benchtop supports)
E	2	6×6×48' Wormanized lumber (table legs)
F	4	6×6×24' Wormanized lumber (bench legs)
G	5	1/2"-dia. = 27' threaded rod (tabletop rods)
H	6	1/2"-dia. = 13 1/2' threaded rod (benchtop rods)
I	22	1/2"-i.d. washers
J	22	1/2"-i.d. nuts
K	16	3/8"-dia. = 6" lagscrews (top fasteners)
L	12	3/8"-dia. = 5" lagscrews (leg fasteners)

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Adding the fun and flavor of a countertop grill to your kitchen is a surprisingly easy do-it-yourself operation. Using a drill and a sabre saw, you should be able to make all the cuts in the countertop, cabinet, floor and through the house wall to install the unit.

The Jenn-Air grill shown is Model G100 (about \$260), which operates on electricity. It comes with instructions and a template for positioning both the grill and venting duct. The ductwork is not included, but it is available at many hardware, plumbing and heating-supply stores.

First, lay out and cut the hole in the countertop using a sabre saw. To avoid

IF IT LOOKS LIKE JUST ANOTHER HAND GRINDER, LOOK AGAIN.

Do it easier and faster with Dremel. The Moto-Tool does projects that used to take many hours in a fraction of the time. Home repair projects become easier and more enjoyable to handle. Variable speed control (5,000 to 28,000) RPM lets you dial the speed to fit the job. The Dremel Moto-Tool—buy it wherever fine power tools are sold. Dremel, Div. of Emerson Electric Co., 4915-21st St., Racine, Wisconsin 53406.

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Using manufacturer-supplied template, mark the countertop for grill location. Because the unit eliminates the need for an exhaust hood, it can be placed just about anywhere you want it.



After you have cut countertop, use same template to mark the location of the smoke-vent ductwork. By lining up the duct carefully now, attaching the two will be much easier later.

marring the laminate, put masking tape on the saw's shoe.

Next, position the duct and make all necessary cuts accurately. The grill attaches to the duct, so there is no margin for

error. After the ductwork is through the floor, make the necessary turns using elbows to run it outdoors. The duct run should be as short and straight as possible. The manufacturer supplies a table for

figuring the ideal duct length for your particular model. Follow these instructions.

Use the vent itself to precisely locate the hole to be cut in the outside wall. For

(Please turn to page 170)

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When ductwork is positioned, the grill can be lowered into it and attached. Secure joints with at least four sheet-metal screws, staggered on both sides of joint.

(Continued from page 169)

the neatest job, locate and bore through at center, then finish making the hole from the outside. If you have a brick-veneered house, bore with carbide-tipped masonry bits and secure the wall cap, using anchors intended for masonry.



A hole is cut to the outside just below floor level and the wall cap is installed. The cap contains a damper to prevent backdrafts when the grill is not in use.

Allow at least one day to make the installation, not including the wiring, which should be done by a licensed electrician (unless you have the electrical knowledge to do it yourself).

For complete information write: Jenn-Air Corp., 3035 Shadeland, Indianapolis, Ind. 46226.



Grease trap below the grill is a glass jar that can be easily removed for cleaning.

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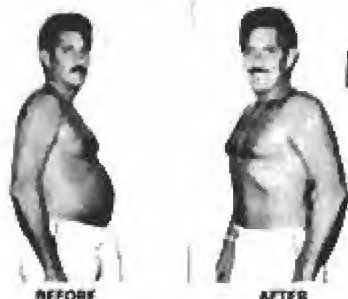
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"I tried every method on the market only to lose a few pounds and then gain back more. Then my husband sent for your Shrink Wrap, and my first thought was, 'more money wasted on fads.' Oh, how wrong I was! With Shrink Wrap, the exercise program and a sensible diet, the weight began to DISAPPEAR! I lost 52 pounds! I lost 8 inches from my waist and 11 inches from my hips. Now, I tell all my friends about Shrink Wrap. Thank you, thank you!"

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off waist and hips!"**

Ms. Lorena Dene Fair—Pontiac, Mich.



"I've been overweight for as long as I can remember, as a child, as a teenager, and as a young adult. Nothing seemed to help. I never had a real shape, or a waistline. I decided to order the Shrink Wrap System, and it worked miracles! 18½ inches off my waist, 16 inches off my hips, all in only 8 months. Shrink Wrap even helped me to stop overeating when I wore it at mealtime, and stop snacking when worn every day. I lost 124 pounds! What can I say. I'm a new woman! Thank you Shrink Wrap. I'll never give you up!"

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*Mr. James Carlisle, Manager
Karate School of Champions
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"Every month my new students arrive overweight and out of shape. We found that the really difficult areas are the stomach and sides; this flab stood up to sit-up after sit-up, until our school purchased a few Shrink Wraps. The results were FANTASTIC! Students wore the Shrink Wraps and literally melted away inches from their waist and hips!"

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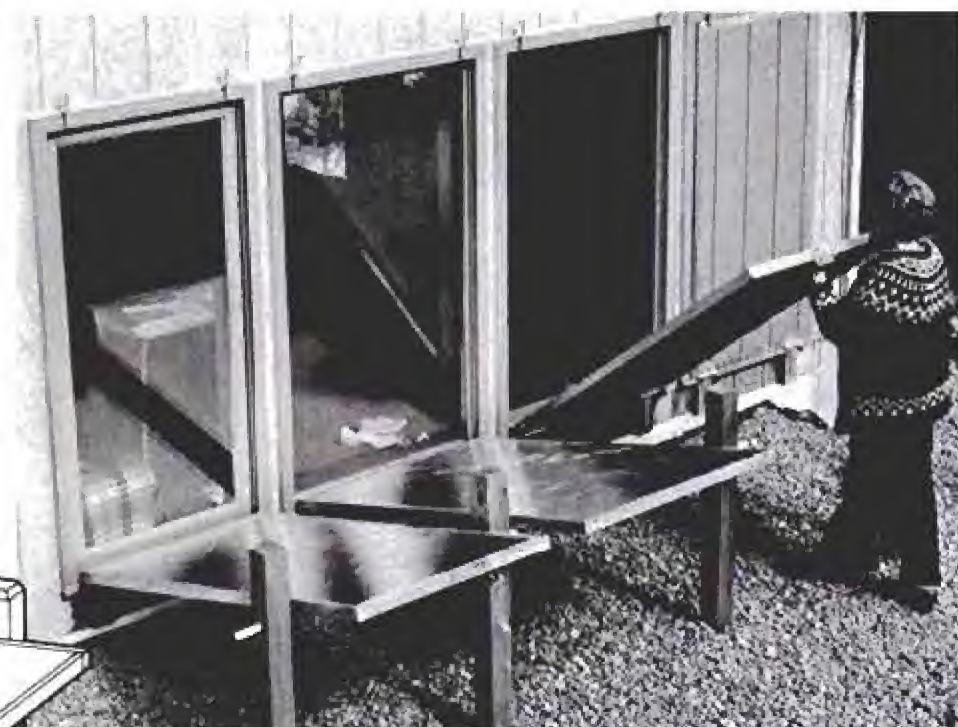
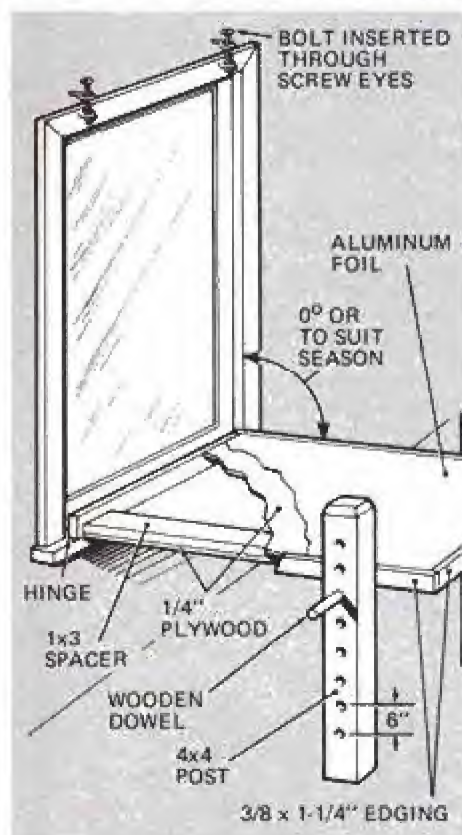
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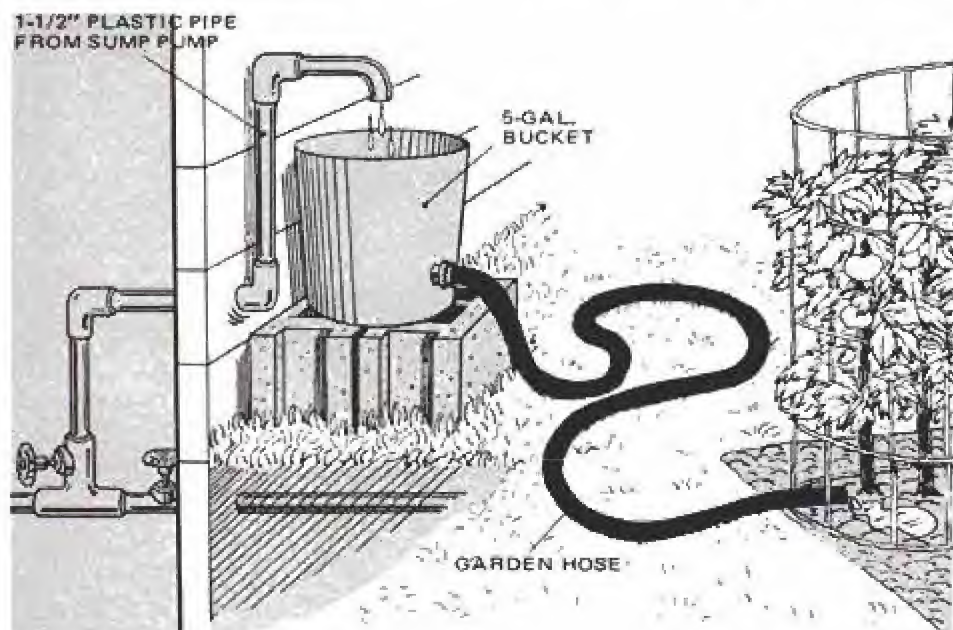


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the shutters closed is to use bolts slipped into screw eyes installed in the siding and window casings.

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For maximum sunlight, alter the reflecting-surface angle as the seasons progress. Hold the shutters at an angle with posts and dowel stops as shown. **Caution: Don't use this type of shutter on windows that may be needed as a fire-escape route.**—Lawrence E. Nielsen, Redmond, Ore.



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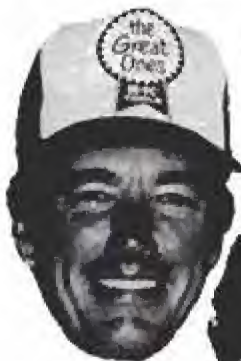
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—William T. Stephens, Macomb, Ill.

(Please turn to page 175)

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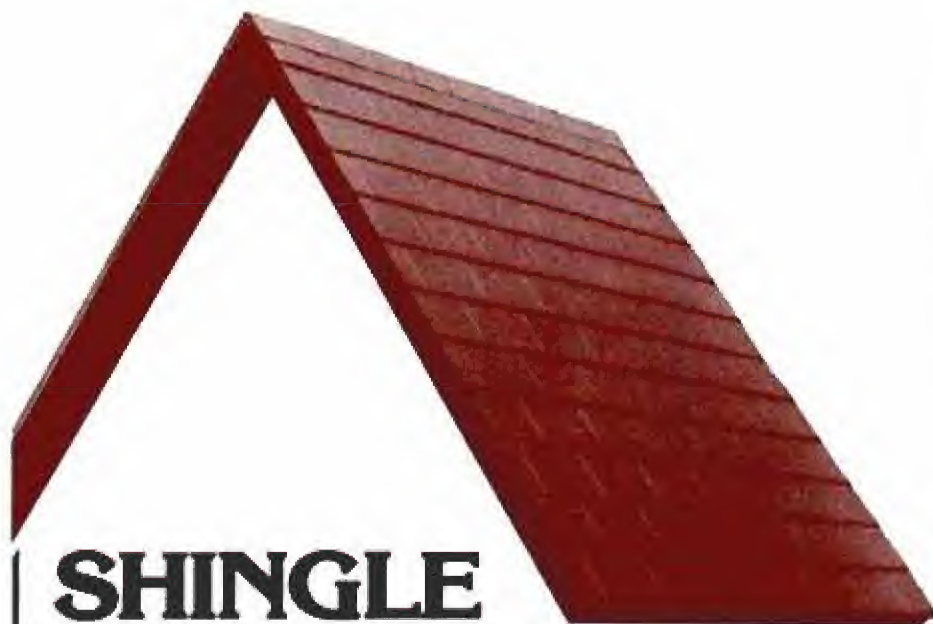
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**Look for our
Car Care Guide
in the
May Issue**

(Continued from page 172)

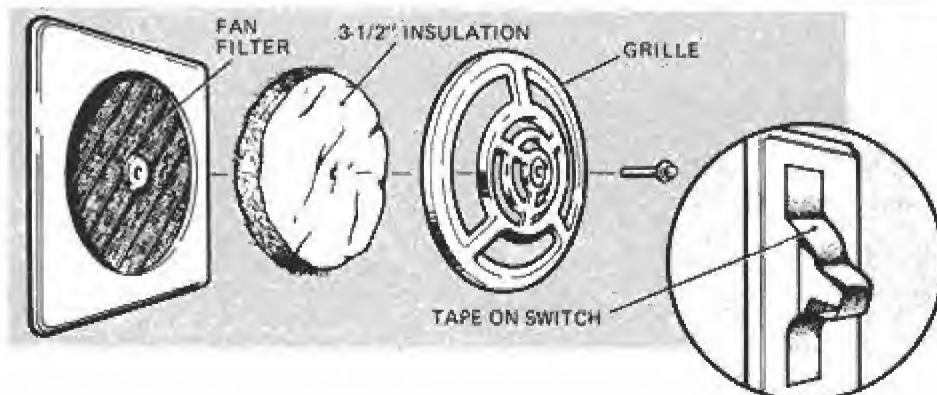
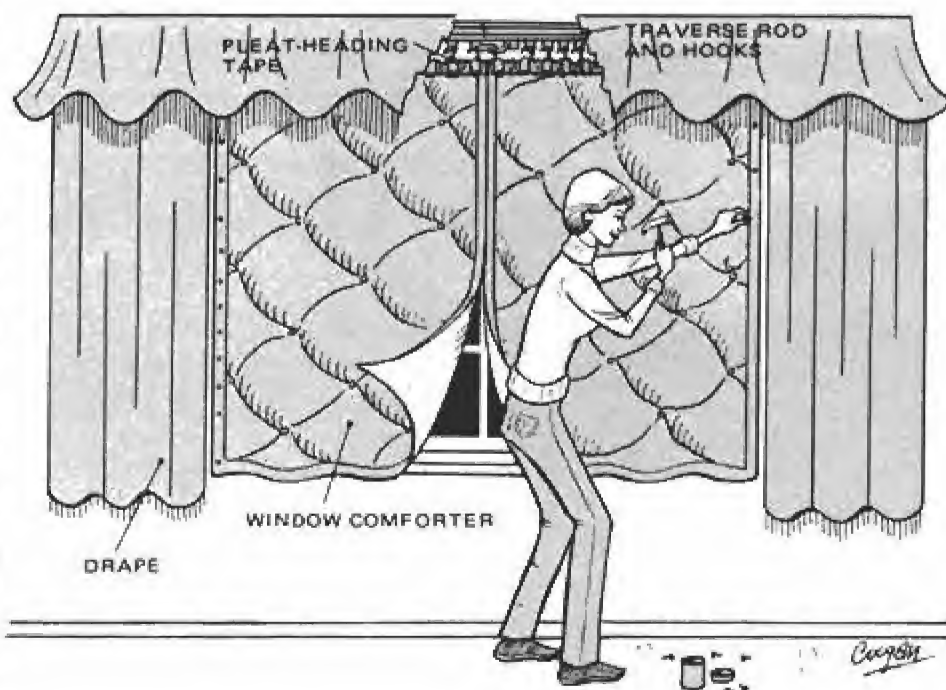
Window comforters

The aluminum-framed picture windows in our living room presented a monstrous heat-loss problem which we solved with window comforters. The comforters are made from a bed sheet folded in half, stuffed with batting and then quilted. Drapery pleat-heading tape is sewn near the top edge.

We positioned the comforters directly behind the drapes on traverse rods hung as close as possible to the window to make a tight seal. We secured the sides of the comforters to the window frames to further seal out drafts.

In the morning, we open both the drapes and the comforters to let in sunshine. Opened or closed, the comforters are completely hidden behind the drapes.

—Linda Wold, St. Cloud, Minn.

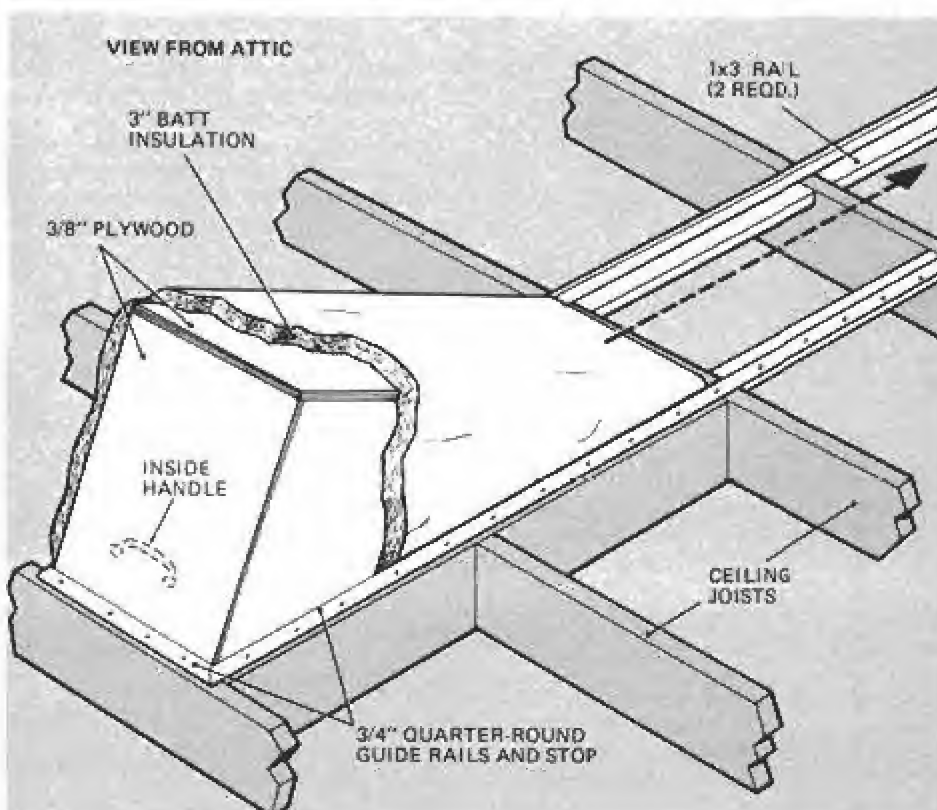


Drafty wall fan

To eliminate drafts and loss of valuable heat in the kitchen during cold weather, we sealed the exhaust fan with foam insulation.

We cut a disc of 3½-in.-thick insulation to suit the diameter of the fan housing. Removing the grille, inserting the insulation and resealing the grille only took a moment. I also taped the fan switch as a reminder that it shouldn't be turned on.

—Michael Greenfield, Oceanside, N.Y.



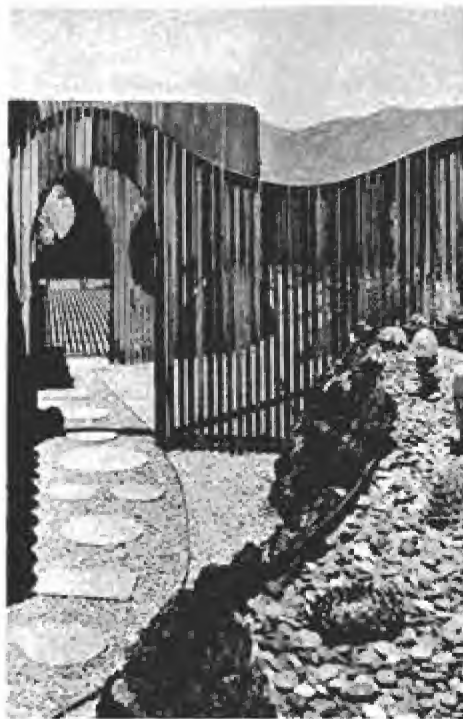
Attic-opening cover

The drafty opening leading to my attic was a major area of heat loss until I built a cover for it. The triangular shape of the cover lets it clear the counterbalance springs and attachment arms of the pull-down stairs.

I constructed the attic cover of four plywood pieces butt-joined together. The plywood is topped with 3-in.-thick batt insulation stapled in place. (Note: For ease in opening, attach a screen-door handle to the outside back of the cover.)

The attic cover slides along joist tops and 1×3 rails installed between joists. Quarter-round molding nailed on top of the joists and rail serves as guide rails for the sliding cover. According to my lowered heat bills, the cover is doing its job in preventing heat loss. —James B. Waters, Inman, S.C.

Share your home energy-saving ideas. PM will pay \$25 for each published idea. Include sketch or photo, if necessary, and a stamped, self-addressed envelope if you want unused material returned. Send to Energy-Saving, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019.

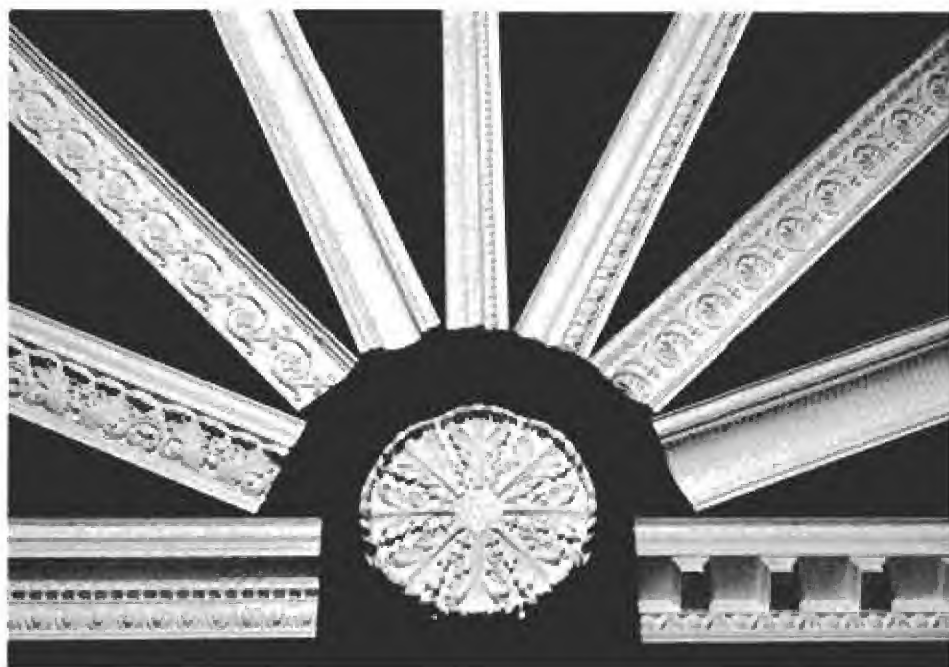


21 NEW PRODUCTS FOR YOUR HOME

Use these flexible redwood strips to create curved outdoor structures such as a winding walkway, arched gazebo or sculptural fence. Redwood Slims come in sizes up to 1/2 in. thick, 6 in. wide and 8 to 20 ft. long. A pack of 12 pieces, 3/4 in. x 4 in. x 8 ft., costs about \$13—more on the East Coast. They're from Masonite Corp., Western Lumber Div., Box 97, Calpella, Calif. 95418.



The Nu-Sash is a custom-made, aluminum replacement window with greater energy efficiency than its predecessors, according to its manufacturer. This is due to a 3/4-in. butyl-sealed insulating glass, an improved polyurethane thermal barrier in the sash and a new interlocking check rail. The windows have both a tilt-in sash for easier cleaning and a newly designed cam-action lock. Frames are available in white or bronze acrylic finish. Solar-control glass is optional. The custom-made windows come in double-hung, picture-window and slider styles, from Nu-Sash, 324 Wooster Rd. N., Barberton, Ohio 44203.



Handsome decorative cornice moldings and centerpieces of reinforced cast plaster are ideal for a new or remodeled home. Castings won't warp and they're fireproof. You can cut the molding with a power saw or handsaw. Embedded nail fasteners allow easy installation. You can paint or spackle the castings as needed. Moldings range from \$3 to \$8 per foot. Centerpieces start at \$27 from Decorative Designs, Box 1692, Elkhart, Ind. 46515.

(Please turn to page 178)



It's easy to hook up this double laundry-tub unit, according to its maker. Each stain-resistant polypropylene tub (\$60) has a 22-gallon capacity and rests on 20-ga. steel legs. Drain stopper, leg-leveling kit and compression nut for hookup are included. A hookup kit is available at additional cost from the maker, Plaskolite Inc., 1770 Joyce Ave., Columbus, Ohio 43216.

This portable multiple-outlet box may be the solution for a home that doesn't have enough electrical outlets. For safety, the unit was designed with 15-amp., press-to-reset circuit breaker. The housing is almond in color. A four-outlet box is priced at \$21 from Cable Electric Products Inc., Box 6767, Providence, R.I. 02940.



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SUZUKI GENERATORS

Distributed through Suzuki Motorcycle Dealers.

You can apply this plastic roof cement, called Wet-Lox, directly from the can without heating it, and it will cover wet surfaces, according to its maker. You can trowel it on in hot or freezing weather. It repairs blisters, wrinkles or cracks in roofs. It also seals and waterproofs flashings, firewalls, chimneys, skylights and gutters. It works



on tar, gravel, slag, concrete, metal or composition roofs. A 5-gallon can is \$31 from Colonial Refining and Chemical Co., 20575 Center Ridge Rd., Rocky River, Ohio 44116.



Although vinyl gutters and downspouts are usually manufactured in white, you can change their color with Raingo Spray Paint. It comes in a 13-oz. aerosol spray can for \$5. The paint is brown in color. You can use it as the finish, or as a primer beneath a good exterior paint if you want to match other trim on your house. Apply the paint to outside surfaces that can be seen from ground level—not to gutter interiors and fittings. For painting over long periods of time, attach a trigger to the can. The paint is from Genova Inc., 7034 East Court St., Davison, Mich. 48423.

Derusto protective coating is a self-priming, semigloss paint that provides rust protection even in tough weather conditions, according to Dap, its maker. You can apply it to most metal or wood. It comes in red, green, black, white and two shades of gray. The finish is said to dry quickly and resist cracking, peeling and chipping. Available sizes range from 1/2 pint to 55-gallon drums, including a 13-oz. spray can. A one-quart can costs \$7 from Dap Inc., Box 227, Dayton, Ohio 45401. (Please turn to page 180)



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You can work as a part-time or full-time siding dealer. Most of our dealers are part-time workers...they use the HOME-KIT as a method of supplementing their regular income.

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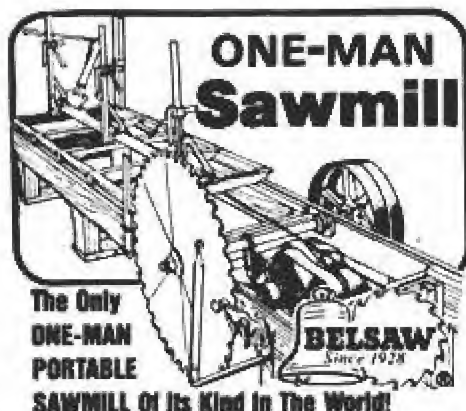
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Kitchen news



Two new wall convection ovens, due in August, also cook food the conventional, radiant way. Deluxe model (top) with automatic meat probe costs \$670; custom model is \$570 from Jenn-Air Corp., 3035 North Shadeland, Indianapolis, Ind. 46226.



New Whirlpool refrigerator/freezer has 17.6 cu. ft. of storage space, but its 30-in. cabinet requires minimal space. It has adjustable shelves and rollers for moving and leveling. Model EHT181AK is \$618 from Whirlpool Corp., 2000 U.S. 33 N., Benton Harbor, Mich. 49022.



Pacific Princess wood range can reduce energy bills of homeowners with a ready wood supply. Cast-iron range, with seamless top and temperature gauge, is \$785 from Pioneer Lamp & Stove Co., Box 4173, Seattle, Wash. 98104.

(Please turn to page 182)

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81 HOME IDEAS GUIDE

(Continued from page 181)

Bathroom products



Bath cabinet and matching swag lamps from the Horizon Collection feature champagne opalescent and textured amber glass with a burnished antique brass finish. A 60-in. chain comes with each light. Lamps are \$154 a pair. The bath cabinet (\$238) fits a 3 1/4 x 14 x 18-in. wall opening. Set is from Thomas Industries Inc., 207 East Broadway, Louisville, Ky. 40202.



This steam-shower unit, called Aqua Steam, is a 48-in. acrylic fiberglass shower stall fitted with a waterproof dome light, tempered-glass door, steam generator and a timer-control mechanism. The stall has a molded seat, built-in grab bar and brass drain. Steam generator is installed and connected at the job site. The Aqua Steam shower is \$1585 from Aqua Glass Corp., Box 412, Adamsville, Tenn. 38310.



Although this wall looks and feels like tile, it's covered with Wall Tiles, a product that is sold in rolls, similar to conventional wall covering. You use adhesive to apply the covering. This Scandia pattern comes in earth tones. It's \$23 per roll from Columbus Coated Fabrics, Div. of Borden Chemical, Columbus, Ohio 43216.

(Please turn to page 184)

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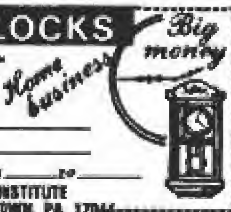
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(Continued from page 182)

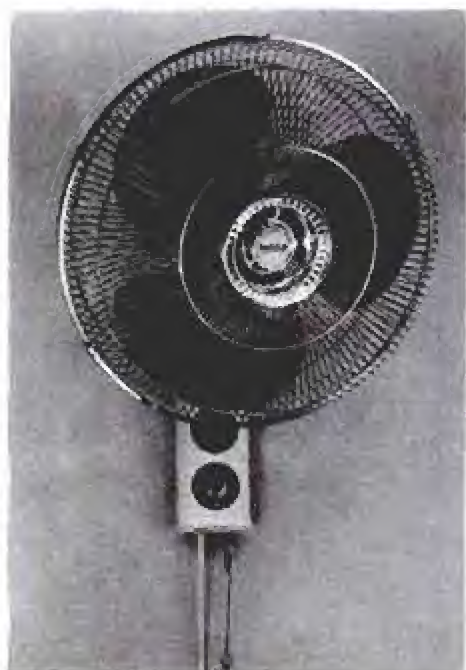
Focus on fans

The Verandah paddle fan circulates air all year long to make you feel more comfortable, while reducing the need, and resultant cost, of heating and cooling your home. This deluxe model, priced at \$400, is finished in brown and polished brass. The motor is vented through a decorative pierced center band of triple-plated brass. It has solid-state speed controls with a selector dial. The 52-in. wood blades (\$50) have a walnut finish with gold stenciling. The four-lamp Chelsea light kit (\$200) has a polished brass finish and variegated amber-and-white glass fixtures. A variety of finishes, light kits and other options are available. It's manufactured by Nu-Tone, Div. of Scovill, Madison and Red Bank Rds., Cincinnati, Ohio 45227.



This ceiling fan, with optional lighting fixture, has hand-rubbed, solid-hardwood blades. It features a reverse-rotation switch, which allows indirect air circulation. The fan has a fully adjustable, variable-speed control from 80 to 240 rpm. The five-globe tulip lighting fixture has a polished or antique brass finish. The fan is priced at \$250; it comes with a five-year warranty. The light fixture costs about \$120 from Patton Electric Co. Inc., 15012 Edgerton Rd., New Haven, Ind. 46774.

Model N-16W is a three-speed, wall-mounted oscillating fan that you can operate by switch or by a remote pull cord. It is an energy-saver, using only 78.5 watts of electricity, according to the maker. The company also says that the wall-mounted fan is relatively simple to install, compared to a ceiling-mounted fan. It costs about \$60 from Nasa Electric Corp., 11 Sorgi Court, Plainville, N.Y. 11803.



PM LOOKS AT

'81 HOME IDEAS GUIDE

NEW GARAGE-DOOR-OPENER PROTECTION SYSTEM

An invisible light-beam obstruction sensor is a feature of Chamberlain's newest heavy-duty opener for use with all types of overhead garage doors. Any break in the light beam, which is installed about 6 in. above the floor, causes a closing door to reopen or prevents an open door from closing. The door doesn't have to "bump" someone to reverse.

A solid-state trinary radio receiver, Model 444 has an on/off switch to prevent operation through a transmitter signal during vacation periods or whenever garage security is desired. The digital radio controls are easy to change to one of 3,375 code possibilities. There is automatic on/off built-in lighting with a 4½-minute duration, independent up and down force adjustment and pull-cord emergency disconnect for manual door operation in the event of a power failure.

The package comes with all necessary hardware and an easy-to-follow installation instruction manual. You can install the unit in several hours using a few ordinary household tools.

Model No. 444, now available at home



An obstruction in the path of the invisible light beam between two sensors will cause a closing door to reopen—the door doesn't have to be touched. The sensor is the dark object near the bottom of the door frame.



Four-section tee rail is assembled with carriage bolts and secured to the opener chassis. A heavy-duty chain wraps around the drive sprocket and trolley and is easily secured with two master links.

centers, is about \$200 and is made by the Chamberlain Manufacturing Corp., 845 Larch Ave., Elmhurst, Ill. 60126.

—Rosario Capotosto
(Please turn to page 186)

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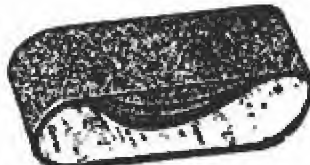


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'81 HOME IDEAS GUIDE

PM LOOKS AT NEW GARAGE-DOOR OPENER

(Continued from page 185)



Tee rail is held on header-wall bracket with a clevis pin (top). Door is attached to trolley with adjustable V-shape hardware plate and door-mounted bracket.



Attractive chassis has built-in lights that turn on when the opener is activated. All adjustments and wiring connections are made on outside of chassis.



Code in radio control can be set or changed by altering digital switch positions. Code used must be the same in both the transmitter and receiver.

SPECIFICATIONS—DOOR OPENER

Motor: 1/2 hp., 1500 rpm, 120 v.a.c., 4.8 amps.
Drive mechanism: length, 1.16 in.; headroom, 1 in.; weight: 52 lbs. 8 oz.; price: about \$200.
Safety features: automatic reversal in either direction, independent up and down adjustment screws, motor overload protector, low-voltage pushbutton wiring, circuit actuated by limit nut, limited adjustment, low-voltage pushbutton, keyswitch or radio control.
Manufacturer: Chamberlain Manufacturing Corp., 645 Larch Ave., Elmhurst, Ill. 60126.

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Make small spaces "super" with this KITCHEN AND BATH COLOR & DESIGN GUIDE. "One Great Space for Living" Kitchen is one of eight space-efficient, colored-neutral designs introduced in this 64-page guide by Ralph Wilson Plastics Co. and three other major home furnishings and building materials manufacturers. \$3.00

388 Ideas Set In Concrete

Transform your yard into an outdoor entertainment area in just a few summer weekends. Sakrete Cement gives you step-by-step instructions for 18 different projects in this 16-page booklet. 50¢

389 Making Money on the Side

Here's a brochure that tells you how you can re-side your home yourself . . . and then make money by becoming a siding dealer. Information on obtaining a Home-Kit and on your own dealership. From Aluminum Industries of Arkansas. Free

390 Need Home Fix-Up?

You can do home repairs and remodeling jobs that last—the easy way. Colorful brochure gives details on DAP products for a wide range of home fixup and paint-up needs. From DAP Inc. Free

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Note: Popular Mechanics processes your requests for the above information and forwards these inquiries to the organization making the offer. Each company mails the material directly. Your order will be on its way to you within 90 days.

391 Build a Low-Cost Energy-Saver House

Tanyon Press would like you to know how to build a home so inexpensively you won't need a mortgage. For less than \$7,000 you build this special-design house that can cut your heating and cooling bills 50%. Complete information package on this home and 49 other styles. \$1.00

392 Inside Story on Insulation

Here's an 8-page homeowner's guide to saving energy. Tells how and where to insulate for economy and comfort. Free from Owens-Corning Fiberglass.

393 Log Home Living Style

A log home can bring the natural beauty of the outdoors and the strength of the forest into your dream home. 4-color brochure shows how you can discover the great indoors, while combining an adventure in outdoor living. From Northern Products Log Homes. Free

394 Making the Grass Grow Green

Wheelhorse is offering its 1981 full-line catalog of tractors and accessories, plus a lawn care booklet. Tips on how to keep your lawn looking good, watering, seeding etc. Free

395 Rockwell 1981 Buyers Guide

This full-color 64-page booklet is your guide to Rockwell's Power Tools and Accessories for 1981. Photos and specifications of each Rockwell tool included along with full descriptions. See the tools that will make your home repairs simple. Just 50¢

396 A Must for Every Homeowner!

The POPULAR MECHANICS HOME CARE GUIDE covers almost every common home repair problem. Tells you how to cut fuel bills, insulate, hang a door, paint, repair scratches in furniture and more. Handy, money-saving hints, more than 135 illustrations and ten tables are printed on 12 double-sided heavy plastic-coated cards, spiral bound. \$4.95

397 Working with Wood

New 1981 four-color, 112-page catalog of over 3,000 products for wood workers. Includes veneers and inlays, fine hardwoods, tools and hardware. From The Woodworkers' Store. \$1.00

398 Gateway to a Living Basement

An attractive, easy operating, lasting steel basement door can increase the usefulness, safety and convenience of your basement. Two fully-illustrated brochures show how to add valuable living space to your home, how to replace worn wooden doors, and detailed instructions for building a brick stairwell and installing your basement door. From Bilco. Only 10¢

399 Everything is Looking Up!

If you've got a ceiling problem, here's a full-color brochure illustrating the newest suspended and tile ceilings and installation methods. Includes information on maintenance, lighting fixtures and accessories. From Armstrong. Free

400 Lawn MOWbilty

The Dixon ZTR riding mower maneuvers easily around trees, shrubs and other obstacles that slow down riding mowers and add to cutting time. Write for Dixon Industries, Inc. product literature featuring Zero Turning Radius mowers with 30" or 42" cuts. Free

401 End Caulk Confusion

This informative booklet explains the difference between the various types of caulk available today. It tells where and when to use caulk, gives helpful preparation tips, and explains the techniques for properly applying caulk for a professional looking job. From Franklin Chemical Industries. Free.

This Coupon Expires June 30, 1981

Total money for priced items \$ _____

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Total money enclosed \$ _____

PM LOOKS AT A FAUCET-MOUNTED WATER FILTER

For those who want clearer, fresher tasting water for drinking and cooking, the Peerless Water Filter features a replaceable five-stage cartridge filter that can remove impurities as small as three-tenths of a micron (a micron is one-millionth of a meter). It screws onto your faucet spout in place of your present aerator. You turn it to the right to get filtered water; to the left to get regular tap water. As the filter becomes clogged in use, it reduces the water flow, telling you it is time to change filters.

According to the manufacturer, a cartridge should last about one month under average use for drinking and cooking only (40 gallons of filtered water). At \$3.19 per cartridge, use the filter only when filtered water is desired. Price of the unit, with one filter cartridge, is \$32.95 at hardware and home centers. —Rosario Capotosto



The head swivels easily. Simple twist changes flow from aerated to filtered.

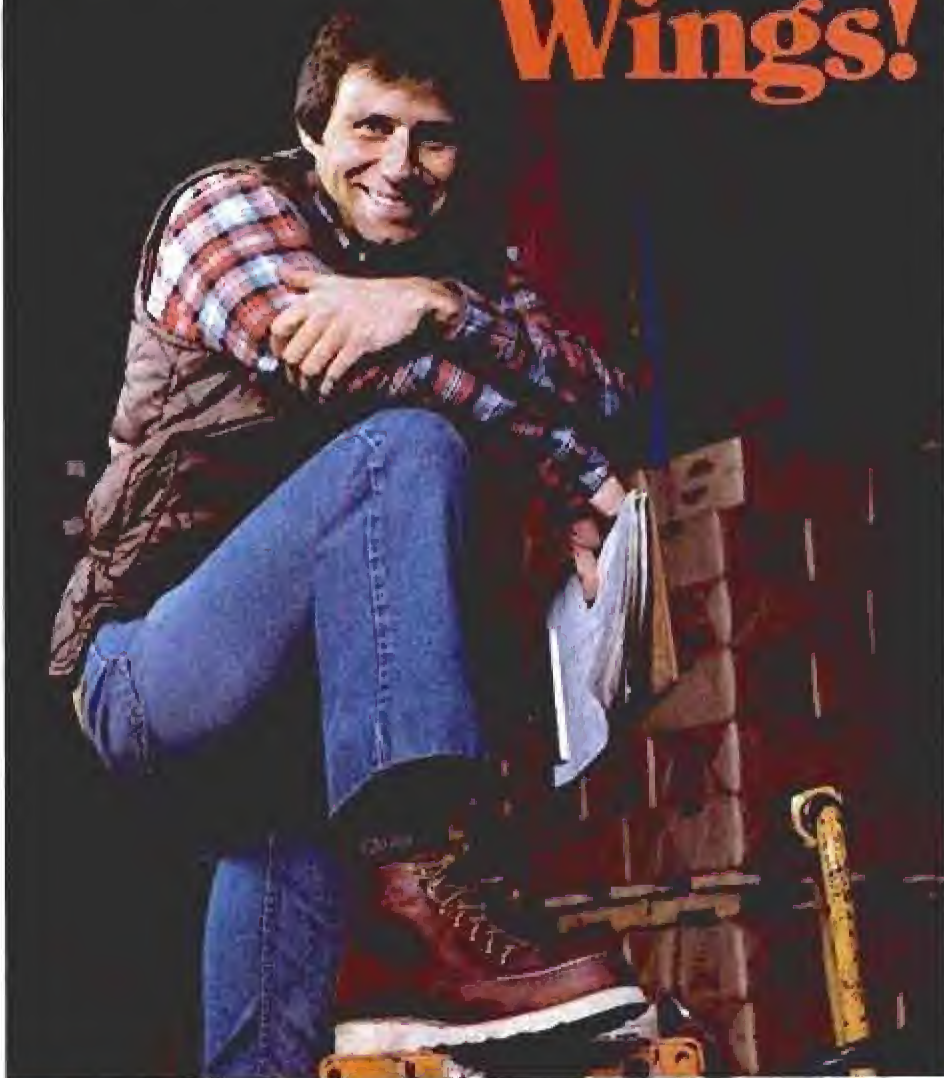


Components of the unit: The darker cartridge has been in use for several days.

SPECIFICATIONS—WATER FILTER

Model: No. RP5506; weight: .37 lbs.
Dimensions: 2.57 x 3.5-in. dia.
Maximum recommended operating pressure: 100 p.s.i.
Manufacturer: Peerless Faucet Co., Div. of Masco Corp.,
Greensburg, Ind., 47240

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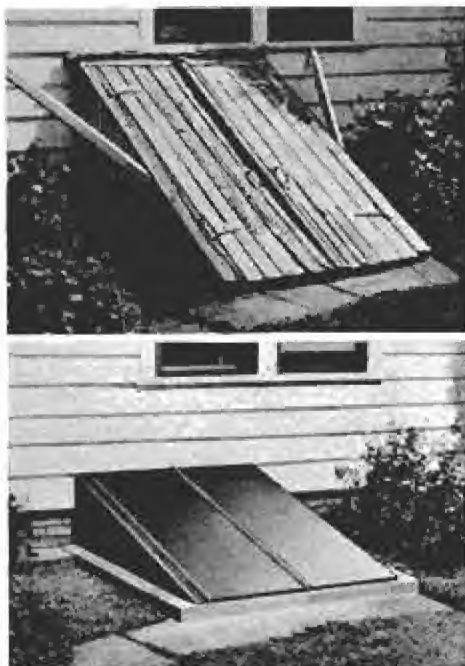
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Cushion crepe wedge sole
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size range 5-10, widths AA-D *
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under "Shoes."

*Size and width
availability
varies with style





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Replacing that troublesome old wooden door with a modern BILCO Basement Door will add new beauty and convenience to your home. You'll like its neat, trim appearance and rugged construction. Long lasting, watertight, safe and secure, it pays for itself in savings on repair and replacement costs. ■ Ease of operation is a special BILCO feature. Torsion rods provide effortless opening and closing of the heavy gauge steel doors. ■ A BILCO Basement Door is also the ideal addition to your present home or the home you're planning. It saves tracking through first floor rooms, makes the basement useful, convenient, safe. Just like adding a whole new floor of valuable living space.



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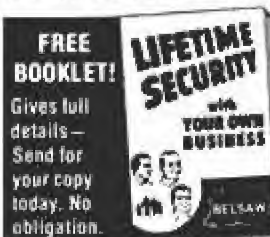
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BUNNY TOY BOX WILL DELIGHT YOUNGSTERS

(Continued from page 124)

painted. The prototypes shown were finished by sealing with Bin pigmented shellac followed by one coat of interior semigloss white latex paint.

The bright, decorative colors are also latex paint, except that they are from a tube. Instead of purchasing pints or quarts of various colors, when you need only small amounts, buy the individual tubes of pigment and mix the colors in the quantities that you need. Water is the solvent.

The bunnies built in the PM shop are, for the most part, colored with pastel shades. Use the color photograph on page 120 as a painting guide. Stir white latex paint into your assorted mixed shades to achieve the desired pastels.

Building the boxes

Because the toy box and pull-toys are intended for preschool-age children, we used lightweight plywood throughout. To keep the construction simple, we assembled the boxes with small cleats (strips of wood) rather than blind dadoes. You can construct the boxes using the latter, of course, but it will require owning a router and the appropriate bits.

Except for the wheels that they roll on, the construction of the boxes is the same throughout, regardless of size. The large bunny has Shepherd casters, while the little toys are fitted with small, wooden wheels from Love-Built Toys & Crafts, 2907 Lake Forest Rd., Box 5459, Tahoe City, Calif. 95730.

Construct the toy box first. Lay out the grid on your piece of plywood. Then, using the grid drawing on page 125 as a guide, transfer the bunny outline to your piece

of wood. Carefully examine your pattern to make certain that you are satisfied with your artwork.

When building any of the boxes, it is far easier and more accurate to locate the positions for the cleats (to which the front, back and bottom panels fasten), while the plywood has square edges. *It is important that mating sides have their cleats positioned identically, or the box will not be square.*

'Mirror' cuts

When you are satisfied with the bunny's shape, and you've marked the location of the cleats, clamp the piece of plywood for the second side to the pattern and cut both at one time. This way, if your saw wanders from the line a bit, the "change" will be mirrored on the second piece.

Fill any voids in the plywood edges with wood filler, then smooth all edges using a file and sandpaper. Break the corners slightly so they are rounded-over.

Measure and cut the pieces for the front, back and bottom. Before assembly, sand all pieces. Use 120-grit sandpaper in your pad sander.

Use carpenter's glue and small nails to assemble the pieces. The cleats which go on first assemble easier with glue alone; add the brads after the glue dries. To do this, apply a small amount of glue to the surfaces to be joined and spread the glue to cover the entire surface. Wait for the glue to become tacky, then press the parts together. Lay a weight on top until the glue has set—at least an hour. Then, use your brad pusher or tack hammer to secure the piece with the small nails.

Use common sense when selecting the size brads you want. You do not want their points coming through the far side. For example, when nailing a 1/4-in.-thick strip

(Please turn to page 192)

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Burr Sizes $\frac{5}{32}$ ", $\frac{7}{32}$ ", $\frac{1}{16}$ " at \$13.95 each

Chain Saw Make _____

Saw Model _____

File Size _____

BUNNY TOY BOX

(Continued from page 191)

to the $\frac{1}{2}$ -in. plywood, you should use $\frac{1}{8}$ -in. brads.

For strength, use 6d finishing nails to assemble the large box parts. First, fasten the bottom to one side, then to the other. Repeat the procedure with the front and back pieces. The casters are installed conventionally, but use $\frac{1}{8}$ -in. pan-head sheet-metal screws for a better bite in the wood.

The pull ropes

Our aim here was to come up with a pull-rope system that was strong enough for a child to tug on, without the awkward look of knots. The problem was resolved by joining the drapery-rope line with wire-butt connectors. (These are the connectors used to join heavy wires, small cables and the like).

Insert the rope through the connector, then return its end back through the terminal to form a loop. Size the loop to suit, then lay the terminal on the anvil of your machinist's vise andpeen it flat with a hammer.

The connectors should be bought to suit the rope diameter that you plan to use. For the smaller pull toys, I simply halved the same terminals with a hacksaw and repeated the procedure.

Use screw eyes on the toys so that your child can line them up choo-choo train fashion, or disconnect them and use them singly. **PM**

MATERIALS LIST—BUNNY TOY BOX

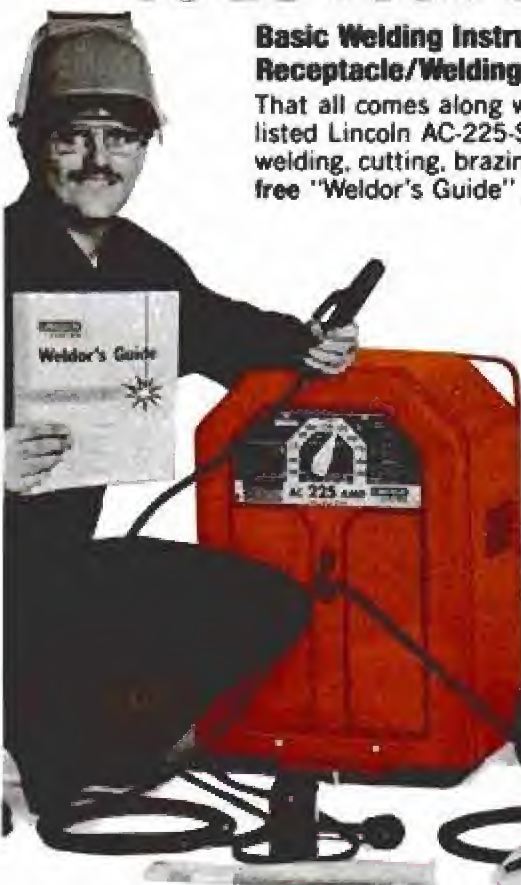
Key	No.	Size and description (use)
A	2	$\frac{3}{4}$ x 14 x 30" plywood (side)
B	2	$\frac{1}{2}$ x 8 x 12" plywood (front, back)
C	1	$\frac{1}{2}$ x 12 x 19" plywood (bottom)
D	2	$\frac{1}{2}$ x 8 x 8" plywood (side)
E	2	$\frac{1}{2}$ x 8 x 10" plywood (side)
F	2	$\frac{1}{2}$ x 4 x 9" plywood (side)
G	1	$\frac{1}{2}$ x $4\frac{1}{2}$ x $4\frac{1}{2}$ " plywood (front)
H	2	$\frac{1}{2}$ x $3\frac{1}{2}$ x $4\frac{1}{2}$ " plywood (front/back)
I	2	$\frac{1}{2}$ x $2\frac{1}{2}$ x $4\frac{1}{2}$ " plywood (front/back)
J	1	$\frac{1}{2}$ x 3 x $4\frac{1}{2}$ " plywood (back)
K	1	$\frac{1}{2}$ x $4\frac{1}{2}$ x $5\frac{1}{2}$ " plywood (bottom)
L	1	$\frac{1}{2}$ x $4\frac{1}{2}$ x $8\frac{1}{2}$ " plywood (bottom)
M	1	$\frac{1}{2}$ x $4\frac{1}{2}$ x 6" plywood (bottom)
N	2	$\frac{3}{4}$ x $\frac{3}{4}$ x 6" pine (cleat)
O	2	$\frac{3}{4}$ x $\frac{3}{4}$ x 19" pine (cleat)
P	4	$\frac{3}{4}$ x 3 x 3" pine cut as shown (caster-mounting block)
Q	2	$\frac{1}{4}$ x $\frac{1}{4}$ x 4" pine (cleat, front)
R	4	$\frac{1}{4}$ x $\frac{1}{4}$ x $2\frac{1}{2}$ " pine (cleat, front and rear)
S	4	$\frac{1}{4}$ x $\frac{1}{4}$ x $1\frac{1}{2}$ " pine (cleat, front and rear)
T	2	$\frac{1}{4}$ x $\frac{1}{4}$ x 2" pine (cleat, rear)
U	2	$\frac{1}{4}$ x $\frac{1}{4}$ x $5\frac{1}{2}$ " pine (cleat, bottom)
V	2	$\frac{1}{4}$ x $\frac{1}{4}$ x $8\frac{1}{2}$ " pine (cleat, bottom)
W	2	$\frac{1}{4}$ x $\frac{1}{4}$ x 8" pine (cleat, bottom)
X	6	$\frac{1}{4}$ -dia. x $5\frac{1}{2}$ " dowel (side)
Y	8	2"-dia. Love-Built wheel (see text)
Z	4	$1\frac{1}{4}$ -dia. Love-Built wheel (see text)
AA	1	$\frac{3}{8}$ -dia. x 3" dowel (handle)
BB	1	$\frac{3}{4}$ -o.d. screw eye
CC	3	$\frac{1}{2}$ -o.d. screw eye
DD	4	$\frac{1}{2}$ -o.d. screw hook
EE	4	$1\frac{1}{2}$ -dia. plate-type Shepherd caster
FF	20	$1\frac{1}{4}$ " No. 8 fh screw
GG	4	wire-butt connector for $\frac{1}{8}$ -dia. cord
HH	1	$\frac{1}{8}$ -dia. drapery cord, 36" long
I	3	$\frac{1}{8}$ -dia. drapery cord, 18" long

Misc.: Carpenter's glue, sandpaper, pigmented shellac, white latex paint, latex pigment in tubes, 1- and 4-in. artist's paint brushes.

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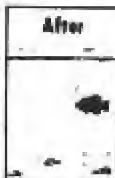
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seat room in the wagon. I took my parents on a long trip, and they loved the spaciousness in the back. I also feel that the Escort has a fair price. The only regret I have is that the Escort doesn't come with a bench front seat."

An Illinois salesman: "The Escort's rear seat has as much room as the 1978 Thunderbird we traded. I also prefer the gas mileage, the styling of the car, the comfort, and the silence on the road. I'm totally happy with the Escort. No problems in 6000 miles of driving. If I have to come up with a 'dislike,' it's that I can't eat a sandwich in traffic because I have to shift the four-speed."

A Wisconsin schoolteacher: "I just love the fwd handling and performance, especially here in Wisconsin's winter country. However, there are some minor complaints. The car needs a larger glovebox. This one's a joke—it's full with one map! The fold-down rear seat never folds completely flat, either."

A Wisconsin office manager: "I like the technical features, like all-independent suspension and fwd. The car seems very solid; good workmanship. I have the GLX package, and the car is very comfortable considering its exterior size."

When we asked for suggested improvements per se, we got these recommendations.

"Needs a five-speed gearbox—too wide a gap between third and fourth."—West Virginia steelworker.

"Takes too long to warm up. Engine



Rear legroom amazes owners of hatchback and wagon, even with the front seats back.

sputters and dies on cold mornings."—Wisconsin office worker.

And an Illinois police chief really warmed to the topic:

"Sun visors are small and rarely block the sun. Gas cap and its fitting, both plastic, release with extreme difficulty in cold weather. Wires in rear area aren't covered; children could easily pull them out. Washer-fluid reservoir is minuscule. Inertia grips on front seatbacks often don't keep backrests from flipping forward—very dangerous when kids lean against them. Seat belts have to be adjusted each time they're put on. Finally, inside the car, at about the middle of the roof, there are two screws pointing downward. I can feel them through the headliner. If someone bumps his head on them, it won't be funny."

In fairness to the Escort, though, 18.5 percent of our interviewees said, "Leave it as is." More than that, fully 30.2 percent voiced no complaints of any sort, which is quite a high score for any car in any price range, foreign or domestic.

On the mechanical side, nearly 65 percent had experienced no problems of any type. The most prevalent mechanical

(Please turn to page 106)

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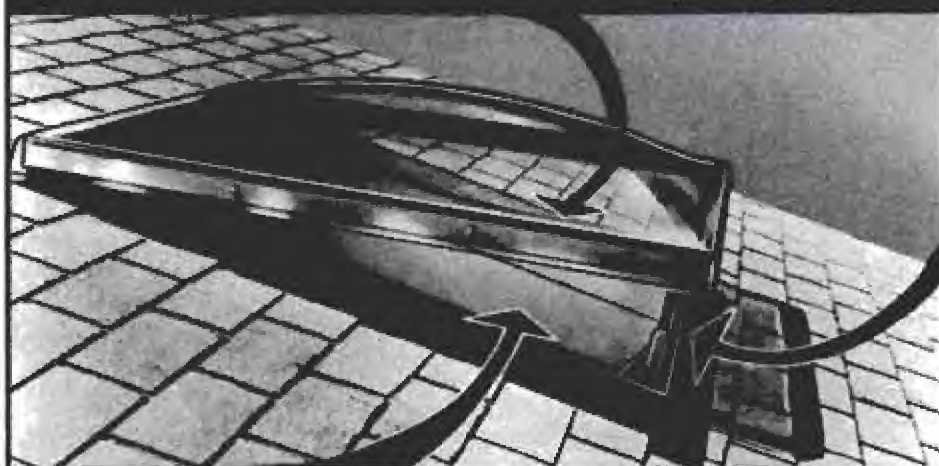


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prised me. I found the Aries felt and handled more like a V8 than a Four. There's no four-cylinder car on the market—domestic or imported—that feels and handles like the K-car. "Workmanship is excellent. The body is so tight that you have to roll down a window to shut the door. I have no complaints at all. When I first bought the Aries, I paid full price and thought it was a little high. Now, though, I feel the car is worth what I paid, but they're discounting the price, so I lost out on about \$630!"

As you can see from our chart at the end of the story, not everyone expressed total happiness with the Aries. An Ohio student, aged 25, noted: "When I took delivery, the shift-rail retaining pin fell out twice, but it's been fixed. There's also a whine from the transaxle due to improperly shimmed bearings. This hasn't been fixed. My local dealer's service department annoys me—too many trips back for the same things."

"General overall quality and workmanship are good but not great. This car shows better fits and has a more solid feel than the Omni I used to own; much improved over the usual sloppy Chrysler workmanship. The Aries also looks nicer



K-cars make good use of space. Even with the front seat pushed fully back, rear legroom is more than adequate for adults.

than the Omni, rides better and has more room. I also appreciate the two-year power-train warranty.

"Fuel economy at an actual 25/38 is nothing to sneeze at. It's economical, with

a good, smooth ride, solid comfort, and attractive exterior appearance. It handles well in snow (no need for snow tires) and luggage space is ample in the sedan. I dislike the day-glow orange panels with idiot lights. But it's a desirable car."

"Front-wheel drive is a new dimension in traction," declares a 34-year-old New York social case worker. "And the 2.2-liter engine performs well. We find the interior space comparable to our old Dodge Dart. We had some rattles, but the dealer corrected these."

A Wisconsin purchasing manager, aged 48: "I've gotten to know my dealer quite well. He tries hard to give a good deal and satisfy his customers. The Aries is my 11th Dodge, and I've tried to pick the 'good years'. My 1979 Omni 024 and this Aries are the best of the bunch. The Aries cost a bit more than I'd anticipated, but I'll double the mileage I used to get from my 1972 Dodge Monaco."

"Mechanical problems have been minor. I'm very fussy and fix many little items myself. The service manager recognizes my fussiness, so he gives me extra attention and lots of free advice."

And finally, we come to a gentleman

(Please turn to page 197)

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complaint centered on the carburetor—maladjustment and hard starting with a cold engine. Some owners also complained of lower-than-expected fuel mileage, but most acknowledged that warm weather and looser engine clearances due to engine break-in could change that situation by summertime.

Those owners who did need service

were generally happy with their dealers: 78 percent rated them "good to excellent." And the one persistent change recommended by do-it-yourselfers was to relocate the oil filter to the front of the engine.

Overall, though, you'd be hard pressed to find a happier group of owners anywhere.

Finally, this from a Wisconsin clergyman, who brings us full circle: "I made a decision several years ago not to buy another American-made car until they built one as good as the better imports. My examination of the Ford Escort convinced me that America has finally gotten the message!"—*Michael Lamm, West Coast Editor*

SUMMARY OF 1981 FORD ESCORT OWNERS REPORTS*

Total miles driven 1,087,982	Handling 57.0	Comfort opinion (front seats):	Dealer service opinion:
Average miles per gallon	Ride 25.5	Excellent 38.6%	Excellent 36.5%
Four-speed manual	Styling 24.8	Very good 44.4	Good 41.5
In town 28.7	Comfort 23.9	Good 13.7	Average 13.7
Long trips 36.2	Specific dislikes:	Fair 2.4	Fair 4.0
Three-speed automatic	No complaints 30.2%	Poor 0.9	Poor 4.3
In town 27.1	Mpg lower than expected 10.5	Comfort opinion (rear seats):	Number of vehicles owned:
Long trips 32.0	Rattles 7.1	Excellent 25.3%	Escort only 40.5%
Transmission choices:	Rear seat doesn't fold flat 6.1	Very good 38.3	Two cars 46.5
Four-speed manual 94.3%	Rough hard shifting 5.4	Good 25.7	Three cars 9.4
Three-speed automatic 5.7	What changes would you like?	Fair 9.3	Four or more cars 3.6
Body-style choices:	No changes 18.5%	Poor 1.3	Makes of other cars owned:
Three-door hatchback 61.8%	Reclining buckets and lat-folding rear seat 12.0	Had any mechanical trouble?	Ford 49.7%
Five-door wagon 38.2	Relocate ashtray 10.8	No 64.9%	Chevrolet 14.2
Why did you choose the Escort?	Other five-speed gearbox 6.8	Yes 35.1	Oldsmobile 9.6
Economy 71.3%	Better fuel mileage 6.5	What type of trouble?	Mercury 7.1
Styling 18.7	Workmanship opinion:	Carburetor 15.7%	Pontiac 6.6
Front-wheel drive 16.8	Excellent 43.5%	Cold starts 13.9	Age distribution of owners:
Made in America 18.5	Good 43.5	Electrical 7.0	15-29 years 21.7%
Size 7.6	Average 10.0	Transmission 6.1	30-49 years 45.0
Specific likes:	Fair 2.4	Dealer repairs satisfactory?	50-plus 23.2
Economy 70.1%	Poor 0.6	Yes 66.7%	Would you buy another Escort?
		No 33.3	Yes 92.1%
			No 7.9

*Percentages might not equal 100% due to rounding or insufficient data.

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from Wisconsin—a 55-year-old insurance analyst who went to considerable lengths to explain why he likes his Aries.

"I have no doubt that your survey will bear out my thinking that K-car owners are way out in front of the pack. There's currently some confusion about K-car quality in view of Chrysler's financial condition. Some thoughtless news commentators twist their limited economic knowl-

edge and conclude that people don't like K-cars. But according to my experience, nothing could be further from the truth. We were the first K-car family on the local road for many weeks. Whenever we drove the Aries, most drivers showed interest and appreciation. My dealer says that all the Aries owners he knows appear happy. So far, no one has brought a car back on Chrysler's 30-day return offer.

"The irony of the Chrysler predicament is that K-car owners are *delighted* with their automobiles. We certainly are. Chrysler Corp. doesn't deserve to fail now, because they're finally producing the quality that we want and need. I have one of these excellent little cars, and I expect to be driving it—trouble-free and economically—for many years."—Michael Lamm, West Coast Editor

SUMMARY OF 1981 DODGE ARIES OWNERS REPORTS*

Total miles driven 1,076,059	Specific likes:	Comfort opinion (front seats):	Dealer service opinion:
Average miles per gallon	Economy 52.8%	Excellent 45.3%	Excellent 43.7%
2.2-liter Four 24.6	Handling 49.2	Very good 38.7	Good 34.0
Long trips 24.6	Styling 34.8	Good 12.9	Average 7.2
2.6-liter Four 32.4	Comfort 24.4	Fair 3.0	Fair 6.6
In town 23.4	Riding qualities 19.1	Poor 0.0	Poor 8.5
Long trips 30.3	Specific dislikes:	Comfort opinion (rear seats):	Number of vehicles owned:
Engine choices	No complaints 28.7%	Excellent 32.0%	Aries only 47.4%
2.2-liter Four 59.1%	Gas mileage below expectations 13.0	Very good 42.5%	Two cars 41.6%
2.6-liter Four 40.9	Car noise and rattles 9.9	Good 18.6	Three cars 7.9
Transmission choices	Price too high 9.3	Fair 4.8	Four or more cars 3.0
Automatic three-speed 72.7%	Quality of materials 6.1	Poor 2.1	Makes of other cars owned:
Manual four-speed 27.3	What changes would you like?	Had any mechanical trouble?	Dodge 30.1%
Body-style choices	No changes 16.0%	No 57.7%	Chevrolet 15.5%
Four-door sedan 77.0%	Lower the price 8.8	Yes 42.3	Ford 13.0
Four-door wagon 23.0	Steering wheel blocks view of instrument panel 7.9	What type of trouble?	Plymouth 12.4
Why did you choose the Aries?	Make bucket seats available 6.9	Transmission 11.8%	Volkswagen 6.7
Economy 60.5%	Use better materials 6.0	Shock absorbers 10.5	Buick 6.7
Styling 27.6	Workmanship opinion:	Carburetor 9.8	Age distribution of owners:
Front-wheel drive 22.1	Excellent 32.0%	Distributor 9.2	15-29 years 10.1%
Size 18.0	Good 43.5%	Battery 7.2	30-49 years 39.8%
Roominess 14.1	Average 14.8	Dealer repairs satisfactory?	50-plus 50.1
	Fair 4.2	Yes 72.1%	Would you buy another Dodge Aries?
	Poor 5.6	No 27.9	Yes 88.1%
			No 11.9

*Percentages might not equal 100% due to rounding or insufficient data.

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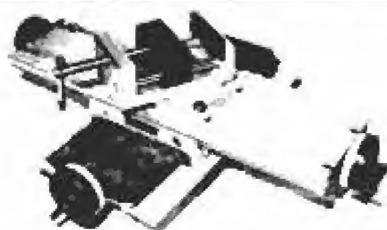
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The no-furnace phenomenon

Investigators say that his principles don't prove out, but architect Lee Butler's clients swear by his self-sustaining solar designs.

Tennesseean Lee Porter Butler, who maintains his architectural offices in San Francisco, was a classic voice in the wilderness a few years ago. That's when he began to talk about dwellings—based on a design he had incorporated into a residence for himself—that could be economically constructed to take advantage of certain passive solar heating principles. What made Butler so easy to ignore, initially, was his seemingly Utopian claim that these homes would keep their occupants comfortable in winter or summer with *no backup heating or cooling requirement.*

Furthermore, Butler said his houses could maintain acceptable limits of human comfort anywhere in the United States. And if you had one built, then felt you needed a furnace after all, *he* would pay for it.

Skeptics were a lot easier for Butler to find than takers—at first. To date, however, more than 50 homes have been built to Butler designs, entirely dependent on the passive solar heating and earth-cooling principles espoused by the architect. Among Butler's clients are a num-

(Please turn to page 205)



Solarium (top) and exterior (above) of a Butler-designed residence near Raleigh, N.C. The south-facing solarium admits maximum low-angled sunlight in winter.

Set on a mountain slope near Lake Tahoe, this Ekose'a—Butler's trade name—house (right) was designed to keep its occupants comfortable throughout the four seasons.





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THE CARS WE CAN'T GET HERE

(Continued from page 115)

cylinder engine gives excellent performance, plus 50 mpg at a steady 55.

I found acceleration brisk if I kept rpms high. The engine *wants* to rev, and the tach goes to 8,000. It's best, too, to slip the clutch, because low-speed torque is weak.

The front seats feel great, with plenty of legroom, but they grab you so tightly that it's difficult to get into and out of them. The rear seats are a joke, but they do fold, providing 6.4 cu. ft. of cargo space. There's one more cubic foot under the hood.

The Suzuki steers quickly and well, thanks to rack-and-pinion plus favorable distribution of weight—only 42 percent of the car's weight is up front. I whizzed along at 75 mph in fourth gear on the smooth British M-4 and felt very much at ease. The car shows generally good workmanship, but it lacks the sealing and insulating qualities we're used to here. That's no big problem, though, and at the right price, this little cutie would make any commuter happy.

Citroen CX 2500D

Citroen offers a wide range of cars for the European market—from the bare-bones 2CV, with its 435-cc opposed Twin, to the big, posh, rocketship-like CX series.

I drove a CX 2500D diesel sedan for one full day in England and nearly didn't give it back. The CX, like the old DS and ID series, has that Alice-in-Wonderland feeling—very cushy, soft, marshmallowy—not quite real. The car glides on a hydropneumatic suspension system. As in previous models, body height can be adjusted

from the dashboard, allowing 6 to 9.5 inches of ground clearance. There's also an automatic self-leveling system to compensate for imbalanced loads.

It took me a while to accustom myself to the Citroen's Varipower steering. At first, the very strong self-centering felt as though it were trying to wrench the wheel out of my hands each time I turned a sharp corner. But I soon learned to grip tightly. Overall, steering is very quick (2.5 turns, lock to lock), and the power assist diminishes as car speed increases, giving good road feel when it counts.

The other driving surprises came when I stepped on the brakes for the first time. I nearly put the CX on its nose. The pedal (actually a small button) stands at accelerator height and has a throw of about 1/4 inch. I found the power assist very touchy. The CX, though, does have four-wheel discs, so there's never any fade.

Handling feels great, despite considerable body lean. The CX has antisway bars fore and aft, which seem to do little good. The steel-belted XVS radials stick well, however.

The CX carries Citroen's only diesel, a 2,500-cc Four that's very quiet and adequately powerful with 75 DIN hp on tap. Driving through a five-speed transaxle, with the top two gears overdrive, this diesel reaches a maximum speed of 97 mph and provides up to 38.6 miles per U.S. gallon at a steady 55 mph. Normal urban-cycle mileage is 26.5—excellent for a car this big and luxurious.

Gadgets abound inside the Citroen CX—air horns, a globe-shaped ashtray, speakers in all doors, bins and pockets everywhere, and jukebox instrumentation with warning lights even for torque-converter oil temperature and hydraulic-system pressure. If you're into the space age, this is your car!



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Citroen Visa

The other Citroen I drove overseas was the much smaller and less expensive Visa Club. This car uses an air-cooled, horizontally opposed Twin—652 cc delivering 36 DIN horses. Like all Citroens, the Visa has front drive, all-independent suspension and a pillow-soft ride.

The Visa Club comes with reclining seats and all the comforts. There's also a four-cylinder, liquid-cooled Visa, the Super, that uses a Peugeot engine, mounted transversely.

Although it's a little econobox, the designers avoided strict convention when the car was abuilding. For instance, the dash is dominated by a single-spoke steering wheel with a control cluster to the left. This cluster is called the PRN Satellite (PRN stands for *pluie, route, nuit*, French for rain, road and night). It controls the wipers, headlights, high beams, foglights, windshield washer and directional signals—a compact and efficient way of organizing the controls. There's also a light on the dash that indicates brake-pad wear.

Performance and handling are astonishingly good for this little box. Its forte, however, is mileage: 37.2 mpg in the city and 56 mpg on the highway at a steady 55 mph.

Fiat Panda

I found the new Fiat Panda not well made, but superb in terms of space utilization. It can carry four adults in solid comfort, and the rear seat can be set in seven different positions.

With all seats folded flat, for example, the Panda's interior becomes a usable double bed. The flexible rear bench lifts out in seconds to reveal a 38.4-cu.-ft. cargo deck. You can hang the rear seat in various positions to

vary knee and luggage space or simply as a hammock. All seats, door panels and glove bin can be removed for washing.

Ital Design (Giugiaro) styled the Panda with a keen eye toward practicality. The impact-resistant bumpers are covered with a Teflon-like synthetic material. The lower body is coated with a gray polyester resin to ward off chips and rust. Totally flat window glass keeps replacement costs to a minimum.

I drove the Panda in Germany and found that the 903-cc transverse engine, borrowed from the Fiat 127, gives adequate performance along with excellent fuel economy. At a steady 55 mph, the Panda averaged 40.7 mpg.

The ride tends to be on the harsh side, and a fairly pronounced understeer can be felt on long sweepers such as *Autobahn* ramps.

Rack-and-pinion steering feels good, with 3.4 turns, lock to lock. The gearshift lever goes a bit limp and strikes the inner sides of both front-seat bottoms at times, which makes shifting into reverse and second a chore.

I also found that the rear edge of both front seats wouldn't stay latched to the floor. This was an early-production car, however.

Fiat 126

The Fiat 126 is a more conventional automobile that's intended strictly for short hops in town: There's room for two adults up front and two kids in back. It has a rear-mounted, air-cooled, 652-cc, 24-DIN-hp, upright Twin that's very thrifty, but is a little rough. It needs encouragement when set into motion from traffic lights. Fuel consumption in U.S. gallons comes to 38.6

(Please turn to page 202)



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THE CARS WE CAN'T GET HERE *(Continued from page 201)*

mpg on the highway and 32.3 mpg under urban driving conditions.

Reliant Scimitar GTC

What the Corvette is to America, the Scimitar GTC convertible is to Great Britain. It uses a production Ford engine, fiberglass body, special chassis and suspension, and it turns heads wherever it goes. Zero-to-60 acceleration takes 10 seconds flat, and top speed approaches 120 mph.

Reliant, not to be confused with Plymouth's K-car, builds the Scimitar in two body types: the two-door wagon (GTE) and the four-place convertible (GTC). Both use the Ford 2.8-liter V6 and can be purchased with either an automatic transmission or four-speed with electric overdrive.

I chose the GTC convertible, which I found very well assembled—nary a ripple in the fiberglass. The interior boasts full instrumentation.

The GTC handles quite well, with

a suspension of conventional A-arms up front and a coil-spring, live rear axle located by trailing arms and Watts links. Nothing exotic, true, but it works. Steering is 2.5 turns, rack-and-pinion, and the Scimitar drives like a dream.

Opel Senator

Here's a sleeper from General Motors of Germany that ranks right alongside the BMW, little Mercedes and others of that ilk. It's an extremely well-engineered, well-built, pleasant, cooperative automobile—comfortable and amply luxurious, without being ostentatious.

The Senator comes in one body style (four-door sedan), with three trim levels (base, C and CD) and two engine displacements (2.8 and 3.0 liters). Engineering is conventional—front engine, rear drive, unitized body. But you get such amenities as four-wheel disc brakes, fully independent suspension, rear subframe, and also a seven-main-bearing, ohc, in-line Six.

The 2.8-liter engine uses a four-barrel carburetor, while the 3.0 has fuel injection.

Engines are mounted in a cradle that includes shock-absorber-type vibration dampers on each side. It is a well-constructed car with a huge trunk, excellent visibility over the sloping hood and easy controls. The standard power steering is valved for good road feel, and I found it quick and precise. Cornering felt very stable.

Performance with the 2.8-liter, 133-hp (DIN) engine is excellent, and it's positively snappy with the 170-hp 3.0-liter. In fifth gear, the engine's turning 3500 rpm at 90 mph, so I'd give this car a top-speed estimate of 128 or so. As I said, it's a real sleeper, especially when you consider its average fuel mileage: about 28 mpg on the highway.

BL's Super Mini

Although the 20-year-old Mini is currently being replaced by British Leyland's new Metro, there's a life in the old pioneer yet. It's been



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improved steadily, and the top model—the one I drove in London—is the 1275 GT.

I found this to be a no-nonsense car, much like the original VW Bug. The Mini has lots of personality, 90 percent of it pleasant. Its very willing, perky 1275-cc Four delivers impressive, sports-car-like performance (54 hp at 5250 rpm), rendering 0 to 60 in 12 seconds, yet giving an economical 33.6 mpg to the U.S. gallon.

The Mini is roomy inside, with good front and rear legroom, despite the 80.2-inch wheelbase. There's much more, and better, insulation



Built by Vauxhall, a GM subsidiary, the Astra has a 1.3-liter, ohc four banger.

inside the new model than in earlier versions, and the instrument panel is now in front of the driver, rather than centered.

Tight suspension gives good control over potholes and rough surfaces. The Mini uses rubber cones instead of metal springs as a replacement for the previous Hydro-lastic system.

Odd as it may sound, the Mini's handling feels fine. Ride is a bit choppy, as expected, and there's also a bit of understeer—nothing overwhelming. I noted little lean in turns, and the car corners well at speed if it's properly pedaled. There's no perceptible torque steer on hard acceleration. The only negative aspect of this car, really, is its undersized 4.0-cu.-ft. trunk.

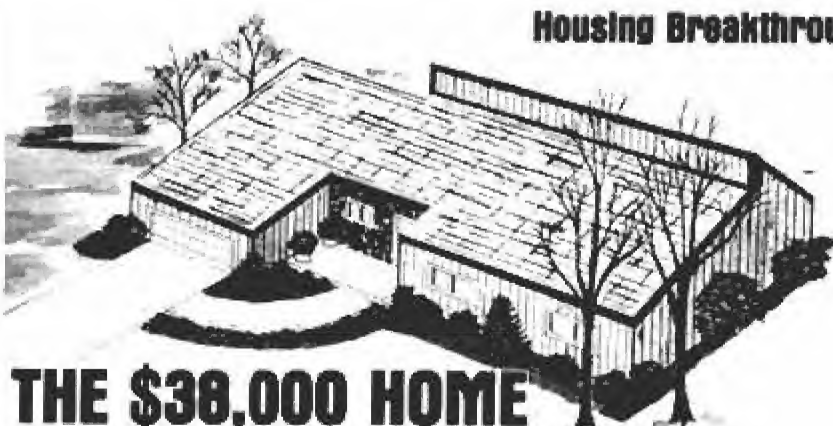
Ford Granada

The German-built Ford Granada—no relation to the U.S. car of the same name—has proportions that are nearly identical to our own Fairmont. But it's an entirely different and, in my opinion, superior car: handsomer and more pleasant to drive.

The ride and handling on the all-independent suspension are far better—no rear-wheel hop on washboard roads. Steering is slightly less precise, but the power assist has more road feel. Europeans do so much nicer work with power steering. The Granada's pedals, too, are

(Please turn to page 204)

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NO OBLIGATION

THE CARS WE CAN'T GET HERE

(Continued from page 203)

more in plane for heel-and-toeing.

Complete instrumentation includes tach, and our Granada had most available options: airconditioning, electric door locks, two-position sunroof, AM/FM six-band stereo with tape, cast wheels, XR suspension and steel-belted Michelins.

The 2.8-liter V6 with fuel injection rates 158 hp—very responsive. And I could feel the lack of smog stumble in this and other European cars, yet I'm not advocating scrapping U.S. smog regulations. Driving or walking in any major European city graphically illustrates the benefits of—nay, the need for—emission controls.

Our Granada was a wagon, which makes maximum use of interior space.

It is very American, both in the way seats fold and in the abundance of storage bins. The European Granada, it seems to me, could be brought over here as a replacement for the defunct Lincoln Versailles, except that the original Versailles cost approximately \$25 million to put on the American road compared to four times that figure for the Fiesta.

Vauxhall Astra

I sincerely hope that GM's eventual replacement for the T-car (Chevette) turns out as well as Britain's fwd Vauxhall Astra (and its German cousin, the Opel Kadett). The Astra makes full use of its well-styled body.

The sedan version contains a hidden hatch trunk of 34.6 cu. ft. There's also a wagon version with a load capacity of 63.2 cu. ft.!

The Astra's 1297-cc, ohc Four delivers 75 hp at 5800 rpm and has an aluminum crossflow head and Varajet II carb. I found no wobble in the stick and felt at ease with all controls.

MacPherson struts, up front, complement conical rear coils on a double-crank twist axle located by trailing arms. It's the same system you'll soon see on GM's upcoming J-cars. Vauxhall includes sway bars front and rear.

I found the overall system exceedingly pleasant in terms of ride, as well as very smooth and predictable in terms of enthusiastic handling.

Fuel mileage ranges from a top of 39.3 mpg to 24 mpg for the British urban cycle (in U.S. gallons), which again makes this a marvelous all-around family car—eminently practical and sturdy in every way. **FM**

THE NO-FURNACE PHENOMENON

(Continued from page 199)

ber who do not hesitate to confirm that the structures work every bit as well as he said they would. At the same time, other designers and builders are offering their own versions of what are usually called "double-envelope" (sometimes just "envelope") homes to the public—although few of them promise independence from fossil-fuel or electric backup systems to the same degree.

So, if the skeptics were wrong, what's keeping this from being the greatest idea since free air? Nothing but official, totally scientific verification. Which is *not* exactly what has been implied in the few studies made

public to date—notably one sponsored by the Department of Energy and conducted by the Brookhaven National Laboratory.

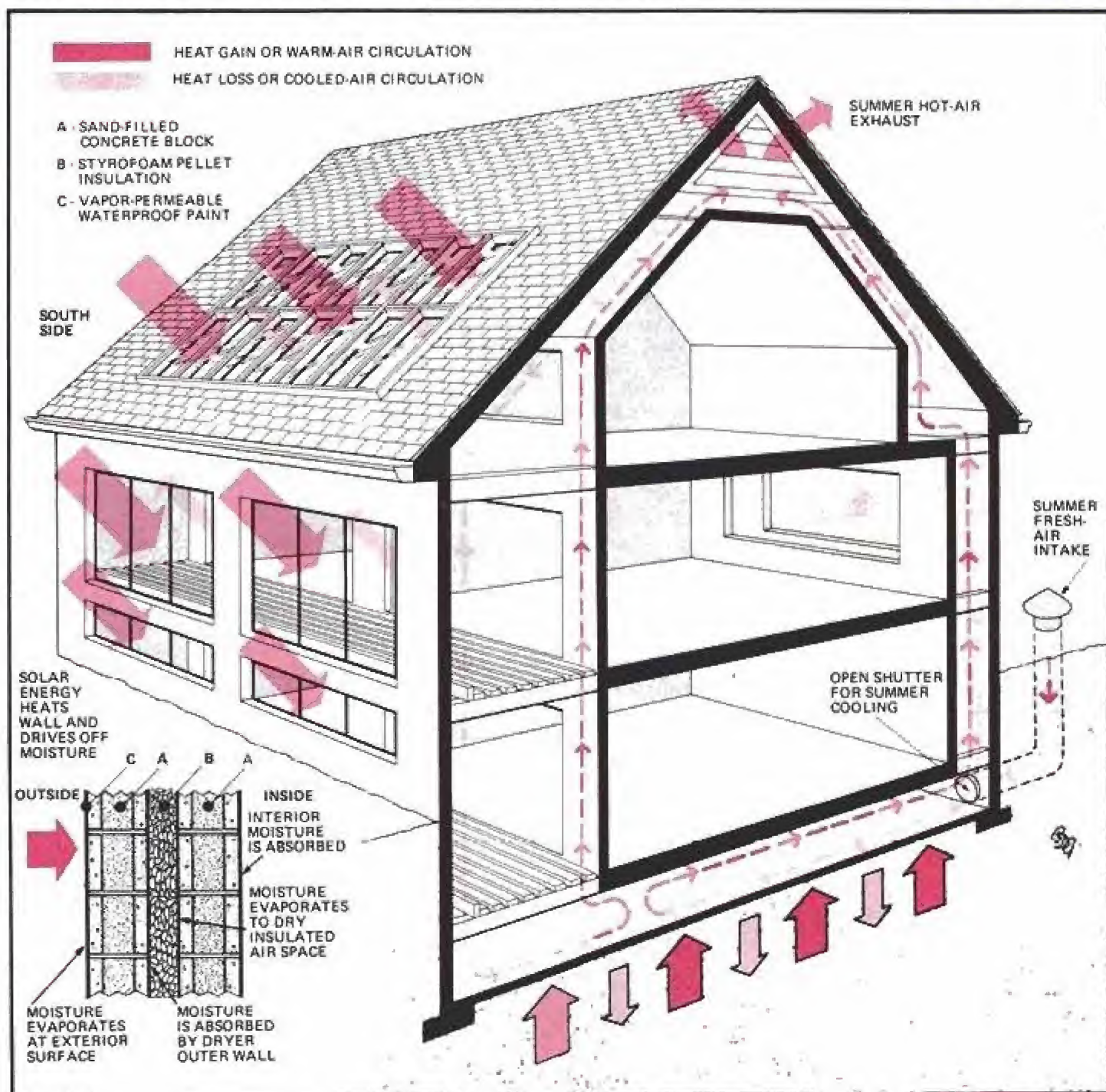
The basic theory

The controversy tends to center as much on points of theory as on questions of overall effectiveness. Our diagram (below) is based on Butler's own explanation of the expected air flow and heat transfer in his structures. Essential elements are the double-wall construction on the north (back) side, and the south-side solarium admitting a maximum of low-angle winter sunlight. According to Butler, any time one wall is gaining or losing heat faster than its opposite number on either the north or south side, convection will move

the cooler air down and the warmer air up. That sets up a flow in the form of two loops stretching from basement to plenum (attic) on either side. During the daylight hours in winter, these loops serve to bring warmer air to the basement, or crawl space, where a dirt floor below frost level serves as a heat sink (absorbs and stores heat). At night, in theory, the stored heat is given off and the air, thus warmed, rises into the living quarters in the same loop-type circulation.

In summer, adjustable awnings control the amount of higher-angle sunlight admitted on the south side; an intake tube (steel culvert) is opened to allow air to be cooled as it flows underground into the base-

(Please turn to page 206)



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THE NO-FURNACE PHENOMENON (Continued from page 205)

ment, and eventually rises to exhaust as warmed air through an attic vent.

Even with Butler's exacting specifications for wall construction, as indicated in the diagram, and the necessity of an extra wall, he maintains the houses can be constructed at costs competitive with standard (stick-built) residential construction. (That, of course, factors in the absence of a heating plant and its requisite ductwork and piping.)

And the more you look at it, the convection/heat-sink/earth-cooling system seems almost too simple to have gone unexploited all these centuries.

"It hasn't," says Butler. "The ancient Arabs, for example, used underground tubes for cooling.

Raves from owners

However simple, once explained, the Butler system has apparently been nothing short of a revelation to some of the people who have invested in it.

Roy Morgan built his Butler house in the Cincinnati area for \$74,000 and has been offered, he says, as much as \$200,000. During the Ohio winter, including some extended cloudy spells, Morgan says the house maintained temperatures ranging from 65° to 74°, with the heat from various appliances—stove, washer, dryer, refrigerator and even light bulbs—supplying all the necessary backup (a feature dependent upon highly effective insulation).

"We moved in during February of 1979," says Morgan, "and we haven't gotten a [monthly] utility bill for more than \$20."

Robert Mastin, an engineer and Annapolis graduate who enjoys showing people around his 2600-sq.-ft. house in Rhode Island, says: "We put in a fireplace for tradition's sake, not out of necessity." Mastin acted as his own general contractor, and figures the cost of his Butler-designed house at \$45 per square foot.

On the summer side of the coin, Sistie Howie, whose residence is in Raleigh, N.C., says his "naturally" cooled house is "a lot more comfortable than most buildings with central airconditioning."

Butler himself falls back on the word "natural" a good deal. In refining his designs over some five years, he says he has developed computer programs that will take into account oxygen content, relative humidity and other heat sources, as well as solar radiation. Butler markets his

designs under the name Ekose'a, an ancient Greek philosophical concept relating to the Earth as a shelter for mankind.

In the light of testimonials from his clients, Lee Porter Butler seems to have moved from solar-energy kook to a man actually demonstrating how the United States could save 25 percent of its total energy expenditure—the amount devoted to residential heating and cooling. Yet there are reservations.

Where's the convection?

In addressing a recent passive solar energy conference in Massachusetts, the Brookhaven National Laboratory's team assigned by the Department of Energy to evaluate an Ekose'a house discussed its findings for the first time. Brookhaven has chosen the Mastin house, near Newport, R.I., for an ongoing study involving elaborate instrumentation and constant monitoring of temperatures and air flow.

In a question-and-answer session following delivery of the highly technical paper, Brookhaven's Dr. Homayoun Ghaffari said the investigation had found air flow in the house, but in both the solarium and the north wall its direction was primarily up. "No siphoning effect was observed," said Ghaffari, "and, so far, what we have observed is stratification, not loop flow. I believe that if there is loop flow, it is minimal and not very observable.

"Also," Ghaffari noted, "temperature in the crawl space (basement) did not change substantially from the normal range of any crawl space—approximating the average ground temperature below the frost line of about 55°. So we conclude that the crawl space does not store much heat from the convective loop."

In another study of an envelope (not a Butler) house, done in Canada, scientists had similar difficulties in finding convective air flow where it was supposed to be, and in establishing that the heat recovery from the dirt floor in the basement/crawl space was as efficient as assumed by the designer.

Yet in both cases, the results are preliminary and the data limited—so we might well ask what difference these fine points of theory make if people are, as they seem to be, living comfortably in these houses without resorting to any major backup heating systems.

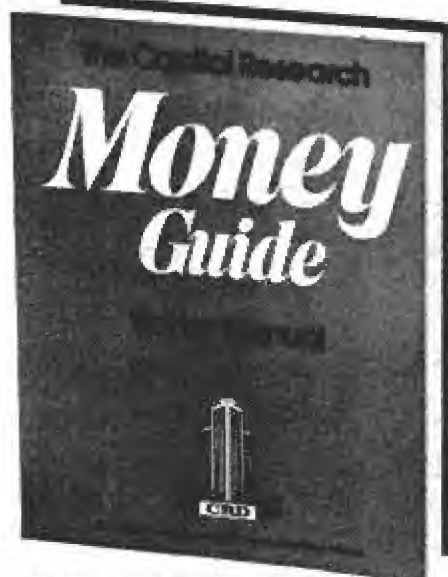
The problem here is one of who is defining "comfort." A number of the early clients of architect Butler im-

(Please turn to page 208)

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THE NO-FURNACE PHENOMENON

(Continued from page 206)

mediately became marketing repre-
sentatives of his Ekose's firm—a
not unusual arrangement in estab-
lishing a dealer network for innova-
tive products or services. Even
though this is based on an owner/rep
having legitimate enthusiasm to be-
gin with, he is effectively removed
from an objective role (as are some
we've quoted).

A comfortable 68°

On the other hand, Brookhaven's
totally objective monitoring of the
Rhode Island Ekose's house during
January 1980, with just three small
(1500-watt) electric heaters—one to
a floor—set to operate at 65° as the
only backup heat sources, showed
that an average temperature of
about 68° was maintained.

To maintain that 68° throughout
an average winter, Brookhaven's
Ghaffari estimates, that particular
house would require a 20 percent
supplemental heating factor—or
the equivalent of \$200 to \$300 in
total energy expenditure. And if you
found, say, 65° to be a comfortable
enough temperature, you could cut
that to almost nothing. As far as
that goes, who wouldn't settle for a
total winter's heating bill of \$200?

The envelope structure concept,
as pioneered by Butler, is unques-
tionably a significant step in the
search for more efficient ways to use
energy that is residual in our envi-
ronment. The controversies concern-
ing the exact mechanisms of
passive solar heating employed in
these structures, and their relative
efficiency in terms of initial costs,
confirm that the overall system has
reached a point of credibility.

Further studies are certain to be
carried out to determine which, if
any, methods of heat transfer, stor-
age or recovery—small fans, for
instance, to assist convection—can
be enhanced within the basic dou-
ble-wall, passive solar design.

Almost every week, some new
variation on a passive solar/enve-
lope structure complex is an-
nounced by yet another designer.

For anyone who believes, as do
some of those quoted here, that the
way to start experimenting is to
build an envelope house, Butler's
Ekose's firm, at 573 Mission St., San
Francisco, Calif. 94105, offers both a
free brochure and a book (\$25) on the
concept. The latter includes a wide
variety of home designs for various
climate zones, plus a discussion of
factors involved in building an enve-
lope house yourself, or acting as
your own general contractor. **PM**

SPACE SHUTTLE: 9 COMPONENTS

(Continued from page 93)

travel, they'll wear fairly conventional flying garb—a mere crash helmet and high-pressure suit. In space, the craft's largest compartment won't be kept sealed. The success of the mission will depend on opening up the 60-foot-long cargo bay, exposing the shuttle's innards so that six radiators can shed dangerous heat. And of course, if all goes well, the biggest difference is that Columbia won't retire to a museum after landing. Theoretically, ground crews will overhaul it and point it back toward space in a matter of days, and it will keep shuttling back and forth to space for up to 100 missions.

Technology behind these unusual mission features is tricky, and success depends on extraordinary performance by thousands of components. NASA, in fact, rates most of the parts, based on their importance—or "criticality"—to the mission.

The criticality books

The ratings fill four books with a total thickness of about six inches. Most of the entries are "Criticality 3": Their failure, while inconvenient, would not stop the mission. "Criticality 2" components are more important; if they break down, the mission will be scrubbed. And the smallest number of items—perhaps 400 to 500, or approximately one out of a hundred parts on the list—are "Criticality 1." They're of such importance that many of them are backed up with redundant systems. The failure of any "Crit 1" part and its backup would probably lead to loss of life.

NASA scientists who keep these books helped us identify nine shuttle systems containing a high number of "Crit 1" components. In these systems, a slight leak or overheated circuit could produce disaster. But most of these systems also contain some of the best technology the United States has ever produced. And all of them have attracted intense scrutiny from a shuttle team backed by 20 years of manned-space-flight experience (see pages 96 and 97). Here's a rundown of systems to watch as the shuttle heads for its debut in space.

Main engines: "It's a whole new sheet of paper," one NASA engineer tells us. There has never been a rocket engine like this.

The pressure in the chamber where hydrogen ignites is three times higher than in any previous engine, providing more brute force per pound of engine weight. But the shuttle's three main powerplants also offer almost fine-tune control. Pilots can throttle them down as the shuttle burns through the rocket fuel and loses weight. And the engines are gimbaled—another innovation—to aim thrust precisely through the orbiter's center of gravity.

Fuel flows through these engines like water through a broken dam: The three main engines consume more than 1,000 gallons per second. To achieve a combustion of this magnitude requires more fancy hardware. Some of the hydrogen is preburned in two small chambers. The force of all of these combustions drives turbopumps that keep the pressure high in the main chamber of the engine.

For the mission to succeed, main engine components have to perform flawlessly for about 520 seconds.

External tank: A tank structure as big as a farm silo feeds hydrogen and oxygen to the main engines, then drops away before the shuttle goes into orbit. One vital detail is a cork/epoxy coating on the tank covered with one- to two-inch-thick spray-on foam insulation. The layers protect the tank from heat during takeoff. Just as important, they insulate cold liquid fuel from outside air. If water in the air were to freeze on the tank's outer surface, this ice would break away in chunks during launch, hailing down on the orbiter vehicle.

Booster rockets: Two solid-fuel rockets mounted on opposite sides of the external tank provide the margin of thrust (more than 5 million pounds) necessary to push the 165,000-pound orbiter into space.

One sophisticated feature of these reusable rockets is that their thrust drops off by a third about a minute after liftoff. This avoids placing too much stress on the shuttle as it approaches the speed of sound. The rockets break away two minutes after liftoff and fall into the ocean where they are recovered.

Maneuvering engines: After the main engines shut down, two small engines take over to deliver the shuttle to a perfect orbiting speed of 17,500 mph. The pair of engines—which can be used singly to nudge the orbiter through speed changes as low as 2 miles an hour—also carry prime responsibility for dropping the shuttle's speed near mission's end to unlock the space-plane from orbit.

Thrusters: These 44 tiny rockets—some with as little as 25 pounds of thrust—give pilots hairbreadth control over the 120-foot-long orbiter. One critical role for the gimballed thrusters is attitude control during reentry when they must work harmoniously with aerodynamic surfaces to keep drag (and resulting heat) down to safe levels.

Cooling system: Heat-removal equipment on Apollo missions to the moon could handle 20,000 B.T.U. of waste heat per hour, generated by the crew and electronic gear. The shuttle cooling system has to be able to handle more than three times that heat—65,000 B.T.U.—about the same amount produced by 200 100-watt lightbulbs all burning at once. In this

case, the added heat is given off by a larger load of electronic gear and a potentially larger crew of up to seven men or women. There are two major heat-dumping systems: eight radiators (six will be used on the first mission) and flash evaporators, devices that simply boil water in a drum using unwanted heat, and vent the steam overboard. Major danger from heat build-up: Computers shut down when the heat is too high.

Computers: "Pilots could black out and the spacecraft could land by itself," a NASA spokesman tells us; five identical on-board computers provide some margin of safety. One is held in reserve, while four others constantly check each other in transmitting pilot commands to rockets or control surfaces, or in carrying out instructions from programs for automatic flight.

The pilots don't need to get involved even if one computer disagrees with three others: The three would automatically overrule the renegade. Reliance on electronics—there are no rods or hydraulic linkages in the shuttle's "fly-by-wire" control system—also makes the shuttle vulnerable to power loss or failure in the cooling system.

Door mechanisms: A moderately simple door latch falls on NASA's "Criticality 1" list because a failure to seal the shuttle bay doors adequately before reentry could destroy the orbiter. The 32 latches—each a hook that grabs a roller—lock the doors to prevent heat from getting into the bay, threatening the integrity of the spacecraft at its midsection.

Tiles: NASA used an advanced form of baking to transform pure Minnesota sand into the 31,000 chalklike square tiles, which, under a microscope, resemble a briar patch. In space, air escapes from this "briar patch," leaving a vacuum between strands of glass. This results in enough insulating ability to protect the orbiter on reentry.

But NASA tells us the tiles will be at greatest risk during the buffeting at liftoff and, a minute later, when the shuttle hits Mach 1. During the first minute, the tiles are subject mostly to mechanical stress—to cracking and breaking away—thereby reducing the armor available for later resistance to heat.

Could the loss of a single tile endanger the entire mission? Not necessarily. A NASA analysis indicates that some parts of the orbiter's underside are more vulnerable than others—for example, areas where fuel lines run close to the aluminum skin.

Like many critical components, the tiles have never flown on any previous spacecraft. NASA's hope is that they will quickly shed their high-tech, exotic sheen and win acceptance as workday parts on a workhorse spacecraft. **PM**

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STP does it all. That's why it outsells them all.

Removes water— fights gas-line freeze.

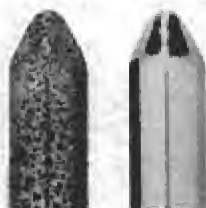
Water gets into your gas tank through condensation and, sometimes, by contamination at the pump. This water can cause poor engine performance and, in cold weather, gas-line freeze.

But the special-action formula of STP Gas Treatment used regularly works to protect your fuel system. It surrounds water droplets and helps carry them through your engine. And the less water in your fuel system, the less chance of a problem.

Inhibits rust.

Even a little rust can cause serious fuel system problems. It can clog your fuel filter, or block your carburetor jet. This can mean hard starting, plus stalling and sputtering.

But STP Gas Treatment has a special rust and corrosion inhibitor designed to prevent these problems. Both these steel bars were soaked in gasoline plus water. But the bar on the right—the one without the rust—was protected by STP Gas Treatment. No wonder it's the Driver's Edge.



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Normal engine heat and oxidation cause gum and varnish to build up. These deposits can clog openings, reduce tolerances and harm engine efficiency.

STP Gas Treatment cleans your carburetor. And works two ways to prevent these harmful deposits from accumulating again. First, it coats

metal surfaces which works to prevent gum and varnish molecules from getting a toehold. And second, it surrounds these molecules with a stick-proof coating so they can pass harmlessly through the fuel system.



UNTREATED TREATED

The carburetor sleeve on the left shows fouling and deposit accumulation. The one on the right—the one that still looks like new—was protected by STP Gas Treatment. Which would you want in your engine?

Saves gas.

A dirty carburetor lessens your engine's operating efficiency, reduces mileage, wastes gas.



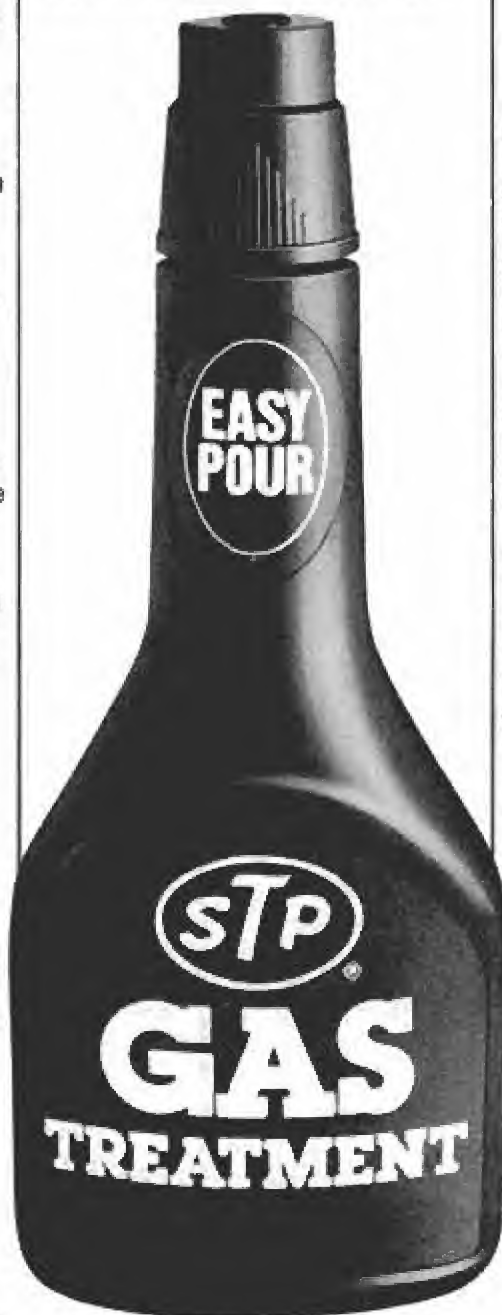
But STP Gas Treatment cleans carburetors. Intake valves and manifolds, too. And, used regularly, **keeps** them clean. Net results: improved engine efficiency and important gas savings.

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STP Gas Treatment **does it all.** Removes water, fights gas-line freeze, cleans carburetors, saves gas. That's why it **outsells them all.**

The driver's edge.



Texas with a full load of 1.5 million barrels of Alaskan crude, loaded at the pipeline terminus port of Valdez. The tanker immediately turns and retraces its wake at a plodding 17 knots.

In addition, another more distant oil tanker, the 850-foot *Sohio Intrepid*, en route to Valdez from San Francisco, and a container freighter, the *Portland*, bound for Anchorage, are alerted. In the tradition of the sea they, too, head for the stricken liner.

Schoel knows that lines on a map don't reflect the real world of air and sea, where wind and weather shape

safety, please report to the promenade deck." That is how passenger Richard Steele, publisher of the Worcester (Mass.) *Telegram-Gazette*, remembers hearing of problems aboard the *Prinsendam* just after midnight on the morning of Oct. 4. Steele and his wife and 322 other passengers—who had paid from \$3,125 to \$5,075 for their accommodations—were on the third day of a 29-day cruise from Vancouver, B.C., up the Inland Passage and across the Pacific to Japan, Shanghai, Hong Kong and Singapore. There, a number of the passengers, a majority of them 65 and older, would cruise

Photo from nearby helicopter shows gutted condition of *Prinsendam's* bridge. Fire is out at this point, and ship is under tow. The damage already done includes numerous exploded ports which will admit water as seas rise, ultimately sinking ship. Dutch maritime investigators, convening in Curacao, N.A., have kept proceedings quiet.



final courses and distances. At best, he sees his combined rescue fleet extended to its operating limits, with critical load factors and fuel allowances already flashing red against the background of the plan as his mind shapes it.

The admiral also knows that luxury-cruise passengers, typically, have spent the better part of their lives earning the luxuries they can afford. With sea-water temperatures lingering in the mid-50s (Fahrenheit), there is no reason why a young, strong person could expect to live immersed in the Gulf of Alaska for much more than an hour. For some of these people, Schoel knows, you could cut that in half.

Later, he'll remember thinking: "It is really a question of whether the Good Lord will give us enough time." At the moment, he doesn't even want to think about the possibility that the remnants of a late-season Pacific typhoon, dubbed Vernon, could be moving into the Gulf within the next eight hours.

"This is your captain speaking. We have a small fire in the engine room. It is under control but for your own

for two more weeks, stopping at the exotic ports of Malaysia, Sumatra, Bali and Java.

The blue-and-white, six-decked, 427-foot *Prinsendam*, built in 1973, was the newest of the Dutch-owned Holland-America fleet of five passenger ships. While also the smallest, with a passenger capacity of 390, the ship's major appeal was, a company spokesman stated, "the absolutely unique voyages through Indonesian waters. It had a considerable loyalty and following."

The ship also had a history of fire. One, touched off by a welding torch during construction, caused several million dollars worth of damage. The other was a minor fire in 1979.

After a day in Ketchikan and a cruise up the scenic Inland Passage to Glacier Bay, the first night on the open sea was unsettling for some of the *Prinsendam's* elderly passengers.

Quite a few passed up the sumptuous offerings in the Lido Restaurant for the comfort and security of their carpeted cabins and the leveling effects of Dramamine.

Far below decks, in the engine



Many elderly passengers suffered from exposure; some were jammed into lifeboats so overcrowded they had to stand.

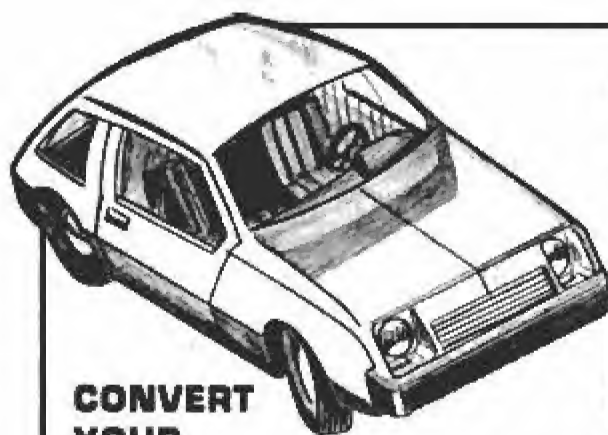
room of the diesel-powered ship, the noisy, oily routine of the engineer's department had been shockingly upset. Fire! The one element all inspections are programmed to guard against had somehow sparked, flared and spread. Almost immediately, the crew that had been grabbed from duty stations, bunks and sleep to fight the flames knew it was fighting a losing battle against the flames.

How had it started? At this writing, only the Dutch Shipping Inspectorate, the investigating authority, has a clue and will not release details until its proceedings are concluded. Asked to speculate by PM, a Coast Guard fire expert suggests that combustion began in or near the filter system of one of the main fuel tanks. It is not known precisely how long the engine room had been afire before the passengers were notified and the distress call sent; yet by 1:00 a.m., the heat and smoke had become so intense in the engine room that the firefighting crew literally had to retreat. They sealed off the engine room and flooded it with carbon dioxide in hopes that this would smother the flames. It didn't have much effect.

The mission begins

"Have we got a mission for you. There are 520 people in the Gulf of Alaska." Air Force Capt. John Walters had just been awakened at 3:00 a.m. (Anchorage is two time zones west of Juneau) by the RCC of the

(Please turn to page 212)



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THE PRINSENDAM FIRE

(Continued from page 211)

Alaskan Air Command at Elmendorf Air Force Base. "You've got to be kidding me," was his response.

An hour and a half later, after briefings based on still-sketchy information coming into the Elmendorf RCC, Capt. Walters and his crew were airborne in their HH-3 ("Jolly Green Giant") chopper. Accompanying them was an HC-130 Hercules four-engine propjet, which would provide both reconnaissance and communications for the rescue, and refueling for the helicopter (only this one Air Force HH-3 had in-air refueling capability). The aircraft also carried five pararescue specialists and flight surgeon Capt. Don Hudson.

The helicopter cut hours from its flight to the Yakutat staging area, about 350 miles away, by clearing Portage Pass, a narrow opening in the mountains, which is almost always socked in at that time of year. "It lifted enough to let us clear with about 100 feet to spare," recalls Walters.

Over Kayak Island, east of Cordova, the HC-130 slowed to 130 knots and extended a 90-foot hose from its wing tip. It then flew up underneath and slightly ahead of the copter until the HH-3 could drop down just enough to connect a telescopic probe from its landing pod into the funnel-shaped device (drogue) at the end of the fuel hose. Coupled, with the HC-130 creating a kind of draft for the helicopter, the two flew low and level at 110 knots as the airplane emptied 1,000 pounds of fuel per minute into the copter until its limit of 4,500 pounds of fuel was reached.

The first explosion

Like a number of other passengers, Isabella and Irving Brex of Seattle were awakened when they felt a shock on the port side. It may have been the first of many small but crippling explosions touched off by the blaze. This was accompanied by a loss of electrical power and complete stillness—no sound of the ship's engines. The smell of smoke in the corridors was pervasive, recalls Irving Brex. When the Captain's request to assemble on the promenade deck was made, the Brexes dressed as quickly and warmly as they could in their pitch-black cabin, took their life jackets and walked out to a rear fan deck. "I was shocked to see so many people still in nightclothes," remembers Brex.

Passenger Steele, up on the prom-

(Please turn to page 214)

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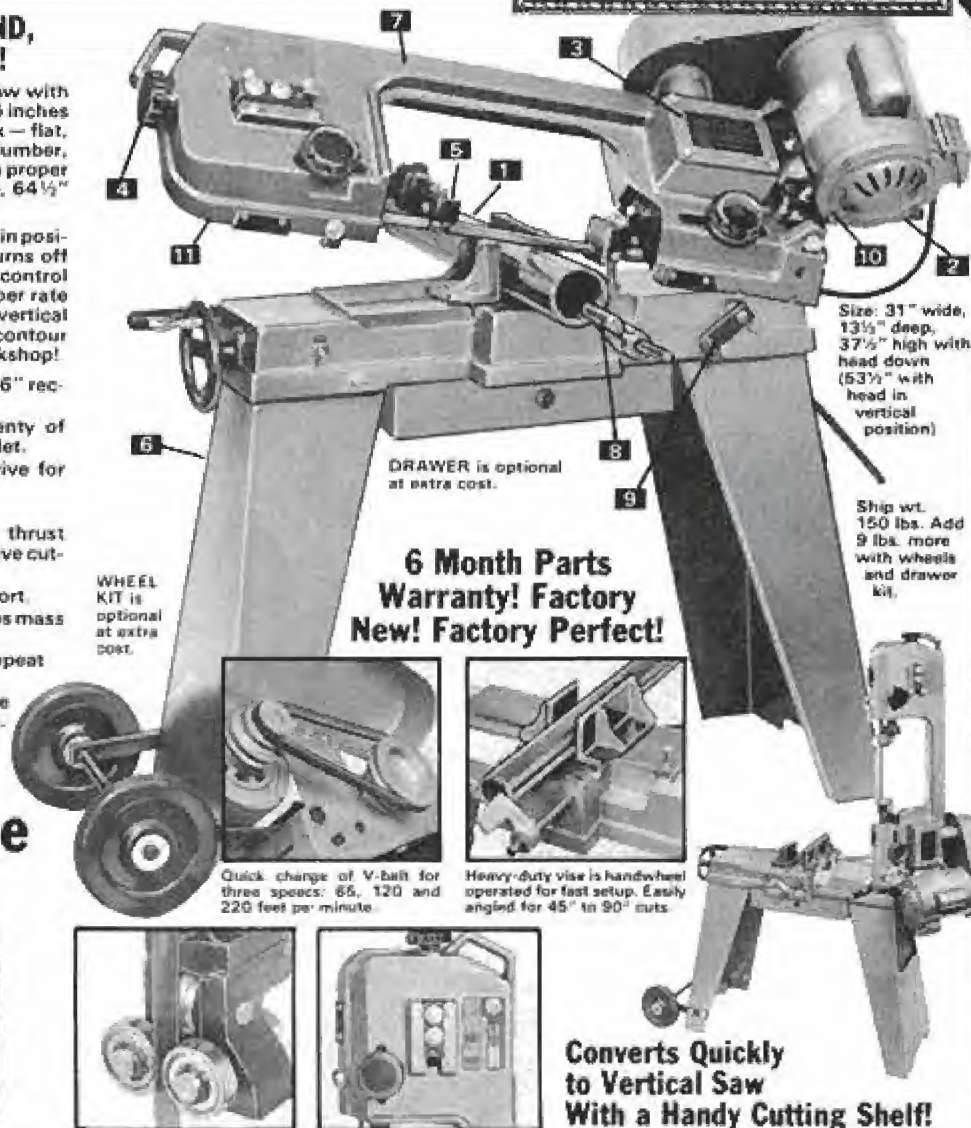
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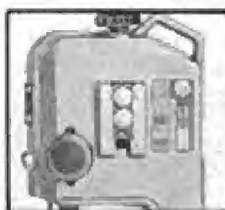
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enade deck, sensed things were not right. "I saw the crew running up and down the stairs with heavy fire-fighting equipment. I started to go back for blankets, but there was no way. The smoke was becoming too thick and acrid."

By 2:00 a.m. the main lounge on the promenade deck was beginning to fill with smoke and passengers were asked to go out on deck. The smaller, posh Prinsen Club, located farther forward, was opened and free drinks were served. An adjacent gift shop was opened up and a clerk gave away sweaters. The ship's entertainers serenaded passengers with songs from "Oklahoma" and "South Pacific." By 3:45 a.m., the smoke had migrated forward again, seeping into the club, and a ship's officer repeated the order to assemble on deck.

The darkness had resulted in some bizarre ensembles: tuxedos and running shoes, nightgowns and furs. Those too thinly clad draped themselves with curtains pulled from the lounge walls.

Efforts to quell the fire over three or more hours had not gone well at all. The carbon dioxide system had only slowed it somewhat; heat and smoke were now, somehow, working their way slowly upward, in the direction of the dining room—four full decks above the engine room on the promenade deck. Although an emergency generator on the bridge deck was working, the fire had caused a break in the electrical system between that generator and the emergency pump below the engine room. There was no water pressure for fighting the flames.

Tough decision made easier

On the bridge, Capt. Cornelius Wabeke, celebrating his 30th year as a ship's master with Holland-America, was contemplating the most painful decision of his career—to abandon ship. The decision was made somewhat easier, at about 5:00 a.m., by the relatively calm prevailing conditions: seas with swells of five feet; temperature, 57°; winds of 10 mph. And daylight was only a few hours away. The forecast, however, was not encouraging.

The rescue forces, mobilized by the RCC in Juneau, were on the move. One of the HC-130 aircraft from Kodiak was the first to locate the *Prinsendam*, at 4:00 a.m., and was circling overhead in its role as on-scene command post. Two Coast Guard HH-3 helicopters, fueled to their limit of six hours flying time, immediately lifted off from their

base in Sitka for the 1½-hour flight to the stricken vessel. In Juneau, police and firemen were actually scouring the city's many taverns and nightspots for the crew of the Coast Guard cutter *Boutwell*, anchored on 24-hour layover during Juneau's Centennial celebration. Its crew secured, if not in prime seagoing condition, the *Boutwell* cast off at 4:00 a.m. with orders to "proceed and assist at best speed." Once clear of the restricted channels, the cutter proceeded at 27 knots.

Overcrowded lifeboats

"I'm sorry. The fire is completely out of control. We have to abandon ship," Capt. Wabeke's order at 6:30 a.m. produced an evacuation that has been described variously as orderly and chaotic, calm and frantic, heroic and cowardly. Six lifeboats, four of them designed to handle 60 to 65 passengers, but jammed with as many as 90, were launched and lowered, along with four small inflatable rafts carrying 25 people. The ship's motor launch got fouled on its davits and hung uselessly against the side of the *Prinsendam*.

Many of the crew members, predominantly Indonesians, were the first to scramble into the lifeboats, actually bolting past elderly passengers for the safety of the boat deck. Some of the Dutch officers took command of the lifeboats and others diligently patrolled the *Prinsendam's* decks, helping passengers to their stations. With all available boats and rafts loaded, some to much more than capacity, 15 passengers and 25 crew members were still left on the burning cruise ship.

PO Michael Oliverson, helping to illuminate the evacuation procedure with a floodlight from a hovering Coast Guard helicopter, recalls that the exercise "looked like a mess." Oliverson, in fact, helped to prevent a major mishap when he blinked the lights to alert one lifeboat and prevent it from lowering itself directly onto another.

For passenger Steele, the descent down the side of the ship was anything but smooth. "I was one of 90 people jammed into a boat that was built to hold 60. There was no room even to sit and no one was in charge. We were lowered to about 30 feet above the water and then the cables jammed. We went up and down like a yo-yo until we finally broke loose and just fell the last 20 feet into the water. Then it took about 25 minutes to get away from the hull because our motor wouldn't work."

Cmdr. Tom Morgan, piloting one of the Sitka helicopters, arrived as the tiny lifeboat flotilla inched away from the burning vessel. He lowered CWO Kenneth Matz, the Coast Guard's fire expert, directly onto the *Prinsendam*. Matz, who had spent 21 years fighting all manner of fires, was most concerned about the idea of being lowered in a basket. "My insides were up around my neck," he recalls, when the HH-3 gently maneuvered to set him down on the stern of the pitching, rolling ship.

Matz, with illumination from the helicopter, climbed through the rubble to the bridge where he conferred with Capt. Wabeke ("He seemed like he was in a state of shock," remembers Matz) and the chief engineer. They all made their way back to the stern where a portable pump, capable of throwing 250 pounds of water a minute, plus extra lengths of fire-hose and additional fire-fighting equipment were being painstakingly lowered onto the ship which now had a vertical pitch of up to 25 feet in steadily rising seas. Matz had to rig a block and tackle arrangement to lower the pump over the side of the vessel and then discovered that the hose-coupling hoses didn't fit. "I had to cut our hose to match theirs and practically fabricate new fittings to adapt to theirs."

With everything finally hooked up, Matz directed a crew to do what it could to cool down the skin of the ship. But after an hour and a half of trying without success to contain the fire, the pump fell into the ocean. "That was the ballgame for us," Matz said. The crew retreated to the bridge over decks which were now so hot the tar in the deck seams was bubbling. There, the remaining crewmen and passengers huddled under curtains, drapes and whatever other fabric they could rip from the walls and attempted to avoid the thick, noxious smoke while awaiting a helicopter lift.

No way for fire to escape

Matz elaborates on his frustrations: "A big problem was that we couldn't vent the fire, give it an avenue of escape. We tried piling plywood against some of the portholes that had been blown out by explosions but that didn't work. The ship kept taking on water through the portholes and from our hose, but without a pump there was no way to get rid of the water. That's why it eventually started to list. The ship was laid out funny. The generator back aft should have been separate from the engine room. It wasn't."

Meanwhile, at 7:45 a.m., the super-

(Please turn to page 216)



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THE PRINSENDAM FIRE

(Continued from page 214)

tanker *Williamsburgh*, the largest tanker ever built in the United States, arrived on the scene to assist in the rescue. Its mammoth presence proved to be a blessing because, carrying a full load of oil, it rode low in the water with its 65-foot draft creating a high degree of stability. It also had a helicopter landing pad on its forward deck and had room in its superstructure for hundreds of people, despite carrying a crew of only 27.

Cmdr. Morgan and his helicopter crew, who had refueled in Yakutat after lowering Matz, were back hovering over the lifeboats with two other copters. "I saw that the passengers from the first lifeboat were having a terribly tough time climbing the rope ladders that had been let over the side of the *Williamsburgh*. It was just too much for those older folks to climb a ladder like that. It was taking too long. I decided right then we've got to start hoisting. They're not hacking it." It was 9:35 a.m.

Heroics by retired nurse

Isabella Brex, who had become separated from her husband Irving in the rush for lifeboats, had now been adrift for five hours. She remembers the *Williamsburgh* coming into view. "Oh, it looked huge," she said. "But, God, it looked good." When she saw that she had at least a 40-foot climb up a rope ladder onto the tanker, she said, "I figured I had no choice but to grab and start climbing. There was no way I was going to spend any more time in that lifeboat." That she was able to pull herself onto the *Williamsburgh* proved to be another blessing: She is a retired school nurse and her medical talents were immediately put to use in helping to treat the hundreds who would soon be deposited on the supertanker.

Cmdr. Morgan's decision to begin hoisting passengers and crew members set off an orchestrated series of lifts by three to five helicopters in which loads of 8 to 15 people, depending on total weight, were hoisted into the copters, flown over to the *Williamsburgh* and unloaded as quickly as possible. The copters would then immediately return to a particular lifeboat to pick up more survivors. If one had to return to Yakutat for refueling, it would take a load of survivors into the town with it.

PO Oliverson, the flight mechanic of a four-man helicopter crew under Lt. Bruce Melnick that plucked 110

survivors from lifeboats and put them onto the *Williamsburgh*, described the hoisting operation. "It took about three to five minutes to hoist one person 20 to 30 feet into the copter," he recalls. "I operated the hoist and gave directional signals to the pilot who could not see the lifeboat below because we were directly overhead. I'm strapped into the doorway in a way that allows me to lean out over the water.

"The basket would be lowered into the lifeboat, someone would somehow crawl in, hold on for dear life, and we'd hoist him or her into the copter. Then another crew member would flip the basket over (crewmen had to literally bang on the knuckles of some frightened passengers to get them to release their grip), and carry the person back in the copter where we tried to distribute the weight evenly. When we reached our weight limit, we'd hustle over to the *Williamsburgh*, unload in about five minutes, and go back for more passengers."

Another crew member described the loaded helicopters as far from being sanctuaries of joy, however. While obviously relieved, the survivors presented a grim presence—snow-white, shocked and nauseated, in various stages of undress and unable to control physical functions. Noise level on the helicopter was extremely high so communication was almost impossible.

No. 6 farthest away

Having made the first at-sea landing of his career to drop blankets onto the *Williamsburgh*, Air Force Capt. Walters lifted off—"ready to go to work"—and picked out a lifeboat that was farthest away from the supertanker. It was lifeboat No. 6, a boat that was to provide the rescue mission with its most anxious hours.

"On a flyover, I was struck by the jam-packed conditions and the age of the people," Walters recalls. "I knew then we better drop our PJs (parajumpers) into the water because those folks would have trouble with the hoist. (Unlike the Coast Guard's baskets, the Air Force copter was equipped with a jungle penetrator, an anchor-like device used primarily for land rescue). Sgts. John Cassidy and Jose Rios, dressed in full scuba suits, jumped from 10 feet into the cold Alaskan waters and swam with survival supplies and flares to the floundering lifeboat.

They helped to strap people onto the hoist and assisted—over a period of several hours—42 people from the boat up into the helicopter,

which then put them on the *Williamsburgh*.

Then, a series of coincidences occurred that was to leave No. 6 adrift with 18 people and the two pararescue specialists for 12 more hours.

Walters's Air Force helicopter was called to the *Prinsendam* to take off the last remaining passengers, crew members and, at 2:30 p.m., Capt. Wabeke. ("He was definitely the last man off the ship," said co-pilot Capt. Bill Gillam. "He gave us a handshake and a thank-you.")

A Canadian Forces CH-46 helicopter on its way to the rescue site lost its instruments and was having problems navigating in deteriorating weather conditions. The Air Force HC-130, piloted by Capt. Dave Briski—the flying gas station for the Air Force helicopter—was called to rescue the Canadian helicopter. Using directional-finding equipment and search radar, the airplane finally located the Canadians in low visibility and escorted them into Yakutat.

Capt. Walters's helicopter returned to lifeboat No. 6 and was beginning to hoist more people when a 20-foot swell hit. It tangled the lifting cable with the lifeboat rudder and snapped it, demolishing the copter's hoist capability. Walters, now running low on fuel and without his refueling source, had no choice but to land on the nearest ship. Fortunately, the 850-foot tanker, the *Sohio Intrepid*, was standing by.

Getting a steer from the *Boutwell*, which had arrived on the scene at 2:30 p.m., bucking crosswinds of 45 knots and flying in visibility of less than one-half mile, Walters and Gillin finally shut down the copter on the deck of the tanker after 30 minutes of delicate piloting. It was 4:57 p.m.

Wide range of problems

On board the *Williamsburgh*, Air Force doctor Don Hudson and his makeshift medical team of paramedics, firefighters and even Alaska State Troopers—all of whom had been airlifted to the tanker—faced more than 250 survivors who presented a staggering range of medical problems.

"There seemed to be a little bit of everything," recalled Dr. Hudson, including a woman with a brain tumor, epileptic seizures, terminal cancer, even one man with a malaria attack. "Everyone was cold and most were suffering severely from motion sickness," said Dr. Hudson. "Six or seven passengers were in advanced stages of hypothermia

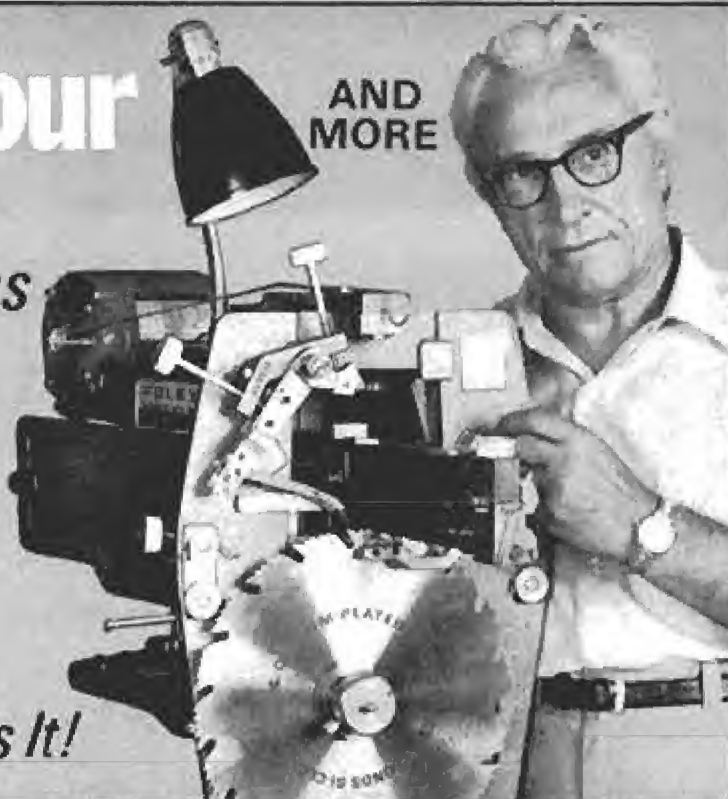
(Please turn to page 218)

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*For Industry and Homes!
Every Neighborhood Needs It!*



AND
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The sharpening business allows you to get started with only a minimum investment, requiring little space and effort for a successful operation. It lets you build and expand as fast, or as slowly as you like. You pocket most of the money you take in, because there are exceptionally high profits with no investment in merchandise.

If you need only \$200 or \$400 extra income each month, a sharpening business is ideal for spare time. The additional dollars can be SPENT for more of the good things of life. Or they can be SAVED in a rainy-day fund that the family can bank on.

More sharpening businesses are needed every year

As original equipment continues to climb in cost, owners are becoming more concerned that the equipment be maintained so that it performs like new. This means more companies, contractors, carpenters and home owners are having their old saw blades and tools resharpened many times, where in the past, they would have replaced them with new blades or tools. This is where you can step in with the much needed service of sharpening saws and practically any kind of tool.

Read What These Foley Shop Owners Say:

**Shop will gross \$40,000 ...
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"I worked in various industrial jobs for years, and always wondered if I could make money for someone else, why I couldn't do it for myself. So after losing my regular job, I opened my Foley sharpening shop in the basement of my home. I only had a minimum of cash to start with, but Foley financed the balance. My shop will gross over \$40,000 this year, and I like the feeling of running my own shop without answering to someone else."

William Weacott
Willoughby, Ohio 44094



Husband and wife have a going spare time shop

"I'm a construction foreman, and my wife is a nurse's aide. Our Foley shop fits in nicely with our regular jobs, and we earn extra money. Our sons help out too, so ours is a real family business."

"I'm still too young to retire, but when I do I'll have a very good business built up. Foley equipment helps us to do good work and brings customers back with more jobs on a regular basis ... we have a lot of repeat business the year around."

Victor Kosloski
Sturgis, Michigan 49091



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Foley

☐ **YES**, I would like to receive complete details about how I can easily start a profitable, Foley-equipped sharpening shop. Please rush me your FREE booklet, without any cost or obligation, that gives me full details on how I can quickly start my own business.

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We buy large inventories from companies throughout the U.S. Merchandise becomes available through overruns, discontinues, last years models, close-outs, bankruptcies, bank foreclosures, etc. We offer this vast variety of merchandise for sale to you through our monthly catalog "Liquidators of Inventory". All merchandise listed in our publication is in our warehouses. This merchandise changes each month as orders are filled and new inventories brought in. The monthly catalog you will receive will include all new merchandise recently acquired. Everything sold is new and unused. Many items can be purchased from us at below manufacturing cost.

Pictured below is a sampling of just a few of the items appearing in a recent publication.



20" Cast Iron Fireplace Grate
Sug. List \$19.95 ea.
Our Price \$9.99 ea.
10 Or More \$7.99 ea.

All Cast Iron Heater-Stove
Sug. List \$149.95 ea.
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10 Or More \$49.95 ea.



Goodyear Wheel
11 x 4.00-5 Two ply
3/4" I.D. Bearings.
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Galvanized Steel 5 Lb. Folding Boat Anchor
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10 Or More \$4.99 ea.

The Green Machine
Nylon String Weed and Grass Trimmer - Model 1200
Sug. List \$59.95 ea.
Our Price \$24.95 ea.
10 Or More \$22.95 ea.



50 Ft. Outdoor Extension Cord
16 Gauge-2 Wire
Sug. List \$8.79 ea.
Our Price \$4.49 ea.
12 Or More \$3.99 ea.

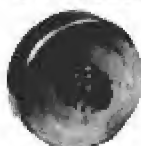


Mini Bike Clutch
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Tecumseh/Craftsman 3 1/2 HP. Engine
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This catalog is an asset to anyone interested in purchasing merchandise such as lawn and garden products, motorcycle and mini-bike parts, tools, agricultural goods, electrical products, household items and all types of hardware and industrial stocks.

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Name _____

Address _____

City _____

State _____

Zip _____

Signature _____



PM

PRINSENDAM (Continued from page 216)

(dangerously low body temperature) and I was sure someone was going to die. We had three people that I would say had less than an hour before they were irreversible."

Dr. Hudson and his troops quickly instituted a system of triage—separating the most critical cases and taking care to slowly warm them back to normal. They organized a buddy system among the survivors so everyone was always being watched by a partner. Medics rotated among the survivors who were sprawled everywhere on five decks—in corridors, offices, store-rooms, the few cabins, the galley, on deck—examining each one every 10 minutes. Hudson himself kept moving, stopping now and then to look at people.

"As people came on board I would tell them, 'I need you.' 'Watch this guy's eyes.' 'Take her pulse.' 'Keep me posted.' I wanted to get across the feeling that people were going to die if they didn't help me," recalls Hudson. "That kind of involvement got them over thinking about their own ills."

Hudson felt that the age of the passengers contributed to a smooth and orderly operation. "If we had been dealing with people 35 or under, there would have been more panic," he says. "These older people had things in perspective. Their lives were straightened out. The wisdom of the years really paid off."

By 6:30 p.m., the last of the lifeboats was being emptied and two more Coast Guard cutters, the *Melton* and *Woodrush*, stood by as darkness descended. Soon after, the *Williamsburgh*, with some 380 survivors, made for Valdez, 14 hours away and the only port that could accommodate the 225,000-ton tanker. The *Boutwell*, with some 80 survivors aboard, had departed for Sitka earlier.

At 8:00 p.m., the Coast Guard in Juneau, working from the manifest of the *Prinsendam*, plus Holland-America and Customs officials' records, reported that they believed everyone had been rescued.

'Where are my PJs?'

At 9:16 p.m., Lt. Col. Bill Langley, 71st ARRC commander at Elmen-dorf, cabled the Juneau RCC: *Where are my PJs?* Confirmation of the missing lifeboat was quick to come from the *Sohio Intrepid* where Capt. Walters and his crew had been forced down: *PJs left in lifeboat with 20 survivors from Prinsendam. Left with PRC 90 radio and mark 13 flares.*

The Juneau command immediately dispatched the *Boutwell* back out to sea, along with an HC-130 aircraft from Kodiak. The remnants of typhoon Vernon, which had miraculously held off for most of the operation, had now closed in, bringing 35-foot seas, freezing rain and 40-knot winds.

In lifeboat No. 6, Sgts. Rios and Cassidy had rigged a tarpaulin over the passengers to ward off the rain and spray. "They literally saved peoples' lives," said *Prinsendam* cruise photographer Terry Allen, who was on the boat. "Some of the people got excited during the night," said Sgt. Rios. "They kept telling us to use the flares, but we didn't want to use them until we actually had a ship or aircraft in sight."

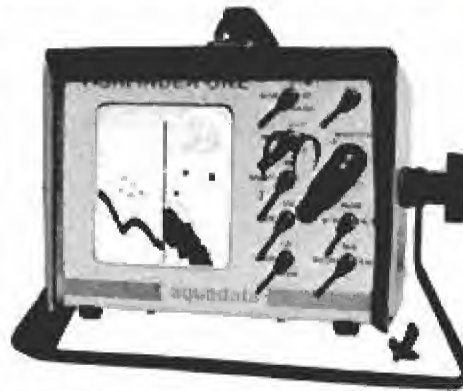
Irving Brex, 67 and a diabetic, was suffering shock from not having received insulin for 48 hours. Brex recalls: "While I was sick as a dog, I initially felt it was only a matter of time until we would be picked up. But after a while, I was beginning to wonder how I was going to make it. I had to force myself to stay awake. I must have hallucinated a couple of times."

Last survivors picked up

Finally, at 1:00 a.m., some 18 hours after their ordeal had begun, they saw the sweeping searchlights of the *Boutwell*. Sgt. Cassidy set off a flare. Then, as the ship's searchlight scanned the seas, Cassidy, a veteran of about 60 rescue missions in Alaska, used a survival mirror to bounce the light back to the *Boutwell*. The ship caught the flash and edged up to the tossing lifeboat. The freezing, exhausted survivors were pulled into the warmth and comfort of the Coast Guard cutter.

The miraculous rescue was over. There had been no deaths or even a serious injury. The final count: 324 passengers, 200 crew—survivors all.

For six more days, the once-sleek, \$50-million cruise vessel was alternately towed and cut adrift to wallow in its own slow agony. It was a sad sight. Debris covered the decks, the bridge was gutted, the hull and cabin-sides scorched with ugly black streaks. Smoke continued to drift from its innards. The *Prinsendam* listed dangerously as it took on more water through its blown-out port-holes. Finally, just after daybreak on the overcast morning of Oct. 11, it rolled slowly over on its side, resting there for a minute and a half, before sliding bow first to the bottom in 8,830 feet of water.



For sport fishermen, the Fishfinder One by Aquadata gives a TV picture of the bottom and can magnify selected depth details.

logged, speed through the water, apparent wind direction and strength, compass headings, and warnings of fire and water in the bilge may be less exciting than satellite communicators—but each can make a passage more comfortable and less worrisome, and can save time and fuel along the way. Hooked together, some can help automate steering.

Radios

Newest for weekend boatmen are little handheld VHF radiotelephones that can be carried along in a dinghy. They range in power up to three watts for Pearce-Simpson's model and cost \$320 to \$500, but offer compact convenience. Synthesizing allows up to 82 channels for nonportable, standard-size R/Ts, from \$330 up.

The limited range of citizens band radios makes them less suited to marine use. In fact, boatmen heading out beyond the approximately 30-mile line-of-sight range of VHF should choose single sideband (SSB) if they can afford the \$1,000 to \$5,000 for long-range transmission.

Weather-band radios, some with automatic storm-warning alarms, plus emergency position-indicating radio beacons (EPIRBs), and manual and automatic radio direction finders, are among the additional radio accessories available.



Radar owners can add Radar Watch Mark II collision-avoidance system that sounds alarm and gives target bearing.

Loran

With the acceptance of more-accurate loran-C, these instruments that can pinpoint location at sea have been teamed with microprocessors to give a skipper an amazing amount of new data, at prices of \$1,300 to \$6,000 and more.

The Northstar 7000 from Digital Marine, for example, can be programmed for up to 20 routes and 60 waypoints to guide you along your course. Along the way, it can tell you the time you have left to go, true speed over the bottom, distance to go, current and wind drift off course, and estimated time of arrival. Positions can be given in loran chart coordinates or in latitude and longitude, and it also monitors signal errors or distortion.

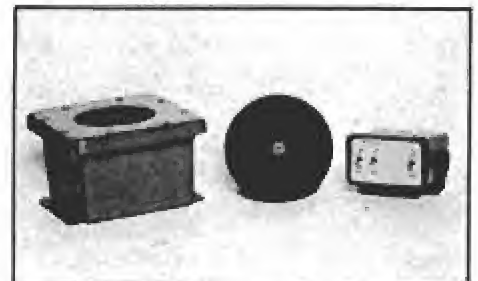
Texas Instruments has taught one of its models how to talk. Its TI9900 loran has a "Speak & Spell" option that uses TI's speech chip to tell a helmsman time, position, speed, range to next waypoint, ETA, off-course error, course made good and bearing—all for an extra \$700.

Radar

Radar units—those remarkable reflection machines that now can show everything out to 50 miles and more—are still expensive. Costs run to \$2,000 and up, but latest add-ons can record tracks of other craft, project intersects that might end up in a collision, and sound alarms.

Satnavs and beyond

Most exotic—and expensive—is a gadget smaller than a breadbox that can check with man-made stars—satellites—and narrow down your position on any ocean to a circle of about 500 feet. Measuring the Doppler effect of passing Transit satellites makes Satnav possible—for only \$10,000, plus installation. Or in a sailboat, a \$2,000 computer system can analyze all the wind and water variables to tell you how to win. Such electronic wonders can't yet think for a sailor, but they certainly help.



Even without radar aboard, Pernicka Radar Detector can sense radar on any approaching vessel, give bearing and alarm.

SKILLED MECHANIC



OR



ENTHUSIASTIC BEGINNER

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COMING YOUR WAY!



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WATCH CAR CARE CENTRAL AND PUT YOURSELF IN THE RIGHT PICTURE!



PM's VACATION HOUSE (Continued from page 109)

ones. These include the following:

■ The functioning greenhouse and spacious deck out front. The latter is built of redwood to assure long-lasting beauty.

■ A pair of skylights to open up the interior. The most dramatic, perhaps, is the kitchen skylight, which focuses daylight on the hanging redwood planter that we created.

■ The most innovative change that we made was in the basement. We aren't the first to include a basement under a manufactured home, but the way that we did it is unique.

Why the basement?

Because we believe that PM readers are active home users, and the type of people who take their hobbies along with them to their country and vacation homes, we decided a basement was a must for this house.

The first priorities were to keep cost down and home comfort up. An all-weather wood foundation made it possible to realize both goals.

The beauty of a wood foundation is that the "feeling" in the room is the same as it is in any other room of the house. The room isn't damp, and since it is well insulated, it's snug. Also, because the walls are framed conventionally, the subsequent wall treatments can be handled in conventional fashion.

To make some of that space below the house usable and practical for workshopers, we installed a pair of sliding doors to the outside. The doors are spacious, and the outside entry makes it possible for a workshopper to get all materials and tools—even a sheet of plywood—into the shop.

A first in a manufactured home—as far as we can determine—is the circular stairway between the first floor and basement. This, of course, permits access to that spacious family entertainment center and workshop, without having to go outside. We located the commercially built stairs in one of the bedrooms, and then converted the bedroom into a two-person work center.

Plans for the projects throughout the house will appear in future issues, starting with the deck and greenhouse which are on page 142 of this issue.

To locate the name of a particular product manufacturer, please read the list on page 109. The names of all who cooperated on this venture are included in that list.

The prototype house shown on these pages is located in Jonesboro,

Ga., about 20 minutes south of Atlanta on Highways 19 & 41.

The delivered price of the house includes normal setup, carpeting and appliances. Property and furnishings are not included, but the furniture shown is available at reasonable cost through Wick dealers.

If you plan on having the wooden foundation put in by the dealer, rather than building it yourself, figure on another \$18,000.

The normal delivery of the home will be three to four weeks from the date the order is placed with the dealer. The house arrives at the site in two sections, hauled by two trucks. It can be erected in a mobile home community or on your own land, provided local regulations permit.

Full assembly of the house, including hookup to electric, water, and waste lines, is included in the purchase price.

The deck and greenhouse were designed by Gilbert Benson; the interior was styled by Debra L. Seaburg, ASID, both with Armstrong World Industries Inc. Construction in the plant was handled by Don Drury, while job site activities were supervised by Donny Russell, Buddy's Homes.

A number of Wick Homes dealers in the Southeast have agreed to erect a bare-bones version of the PM vacation house. That is, a model from the factory, minus the do-it-yourself extras shown in the photos on pages 106-108.

The projects designed for the PM house were created so that they are usable in conjunction with any home, whether factory- or site-built. The bare-bones house gives a lot of living for \$30,000, and the PM projects will make your home a castle. **PM**

HOUSES ON DISPLAY

The Wick dealers listed below have agreed to erect the basic PM vacation home at the addresses shown. The facsimile homes do not include the do-it-yourself features shown in the photos on pages 135-145. (The address of the prototype home is given below.)

A-Bar-G Mobile Homes: 850 Cobb Parkway, Marietta, Ga. 30062.

Abernethy Housing Center: Rte. 17, Savannah, Ga. 31405.
Akins Mobile Homes: Winder, Ga. 30680; Buford, Ga. 30518.

Best Quality Homes: 290 Washington Rd., Thompson, Ga. 30624; 1939 Gordon Hwy., Augusta, Ga. 30901.

Buddy's Homes: 8500 South Expressway, Jonesboro, Ga. 30236 (prototype house).

Delta Mobile Homes: Florence, S.C. 29501; Myrtle Beach, S.C. 29577.

Esquire Mobile Homes: 1235 Broad St., Gainesville, Ga. 30501; U.S. 78 W., Hiwassee, Ga. 30546; 718 South Big A Rd., Toccoa, Ga. 30577; Mountain City, Ga. 30541.

Joe Jones Mobile Homes: 3649 Victory Dr., Columbus, Ga. 31903.

Larry's Mobile Homes: 4235 Broadway, Macon, Ga. 31206.

Oak Knoll Mobile Homes: Hwy. 41 S., Tullahoma, Tenn. 37368.

Scenic Mobile Homes: Snellville, Ga. 30278.

Victorian Lakes Estates: Lexington, S.C. 29072.

NEW FILTERS

(Continued from page 117)

filters shade from deep color to clear glass. You can combine a gray filter with a color one to heighten effects. Or use the gray alone to prevent overexposure of subjects near the flash.

Diffraction filters

Shots taken with a graduated filter combined with a diffraction filter are very effective. The diffraction filter breaks light up into a rainbow prism without reducing sharpness. Result: spectacular colorbursts. Use them anywhere a light source is part of the picture.

Star filters

Light—even reflections of light—can break up into stars with up to 16 rays using these filters. Anything with highly polished metal surfaces can have its highlights photographically starred. Try these filters on a ski trip when the day is icy and sunny for exciting, glittering photos.

Creative filters

Made of gelatin, these filters can be cut into any shape desired. You can customize the filter to shoot a special object or scene with them.

Color filters in pastels, sepia, blue and orange (made of glass) provide an overall color tint. All can contribute greatly to a photo's atmosphere.

Center-spot filters

Glamorous portraits or moody landscapes can be enhanced with a center-spot filter. These have a clear central spot surrounded by a colored or plain diffusion area.

The Cokin system has other special attachments, as well. There are lenses that focus on foreground and background simultaneously, double-exposure masks, even prisms.

Exposure control with some of these filters is tricky, so consider your first few rolls of film to be experimental.

You shoot one exposure a half-stop high, then another a half-stop low, and a third where you think the exposure value should be. For many of the pictures you make with these filters, there may be no correct exposure since filter effects are highly subjective.

If you are having prints done by a lab, tell them you have filtered the shots. Otherwise, photos may be automatically "corrected" by printing machines programmed for normal negatives. Your best bet is to shoot color slides and circumvent the robots in the lab.

774

Rechargeable Aerosol Spray Can!

New British Invention...

Make your own aerosol spray paints, cleaners, lubricants, etc. and save yourself a small fortune.

Environmentally Safe — No Fluorocarbons

Re-fill the Rechargeable Aerosol Can and use it over and over...it actually makes a great deal of sense. When you go to the store and purchase spray paint or any other liquid aerosol spray, you usually pay more for the aerosol canister (plus the cost of filling and pressurizing it) than for the contents. Push-button convenience has been most expensive...but now you have an ingenious and easy alternative.

Fast and simple to operate... Fill the can 2/3 full with the liquid to be used, thinning according to instructions. Screw on the Aerosol Valve Top and pressurize to 50 psi with any bicycle pump, air hose or other air source (a unique pressure relief valve insures against overcharging). When the large (1 pint) can is empty, simply re-fill and pressurize. You're back to the job in minutes. When finished, clean the can thoroughly and you're ready for your next project!



Touch-up body work



Clean photo equip.

Genuine Professional results... without the noise and hassles of a cumbersome and expensive compressor. Starshine's Rechargeable Aerosol is a quality spraying instrument...the first of its kind for home, garden and industrial use. It is available only from Starshine's Mail Order Sales Division and arrives quickly at your door complete with two interchangeable spray heads. One, a wide angle spray, is for flawless application of paints and other liquids requiring an even coating. The other, a special extension tube, is for applying lubricants, cleaners, etc., in hard-to-get-at places such as complex electronic equipment.

For example, a few suggested uses:

- Paints
- Lubricants
- Rust inhibitors
- Solvents
- Engine degreasers
- Photo equipment
- De-icer
- Household cleaners
- Insecticides
- Disinfectants
- Electrical contact cleaners
- A world of applications



Paint metalwork



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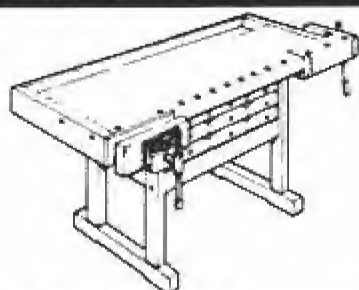
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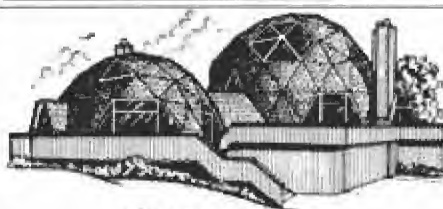


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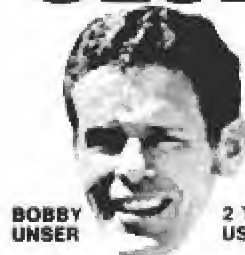
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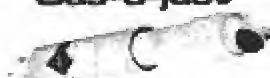
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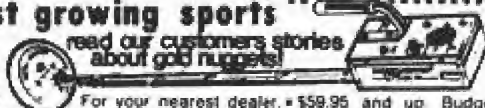
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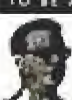
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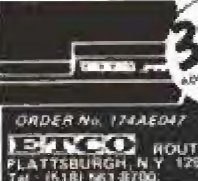
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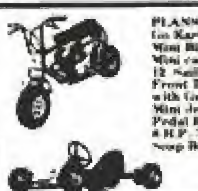
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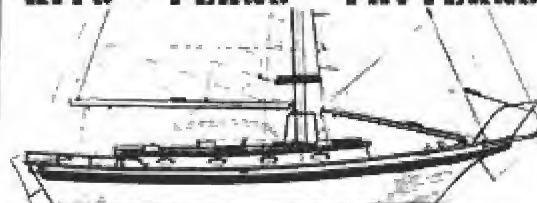
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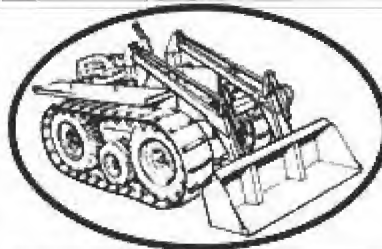


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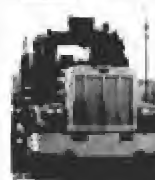
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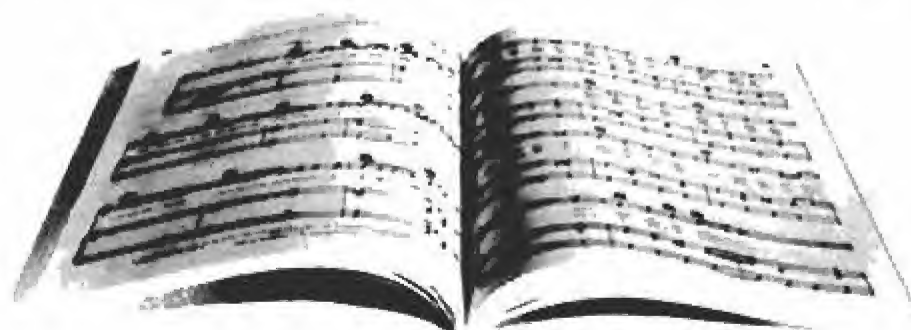
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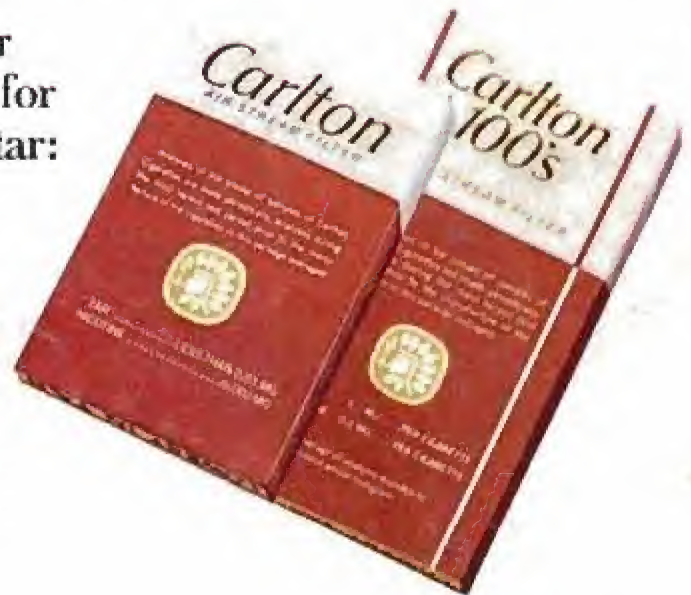
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